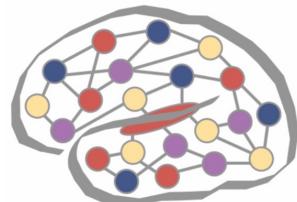


Memory distortions reveal different representations for specific and general knowledge

Marlie C. Tandoc, Cody V. Dong, Anna C. Schapiro

SfN 2022



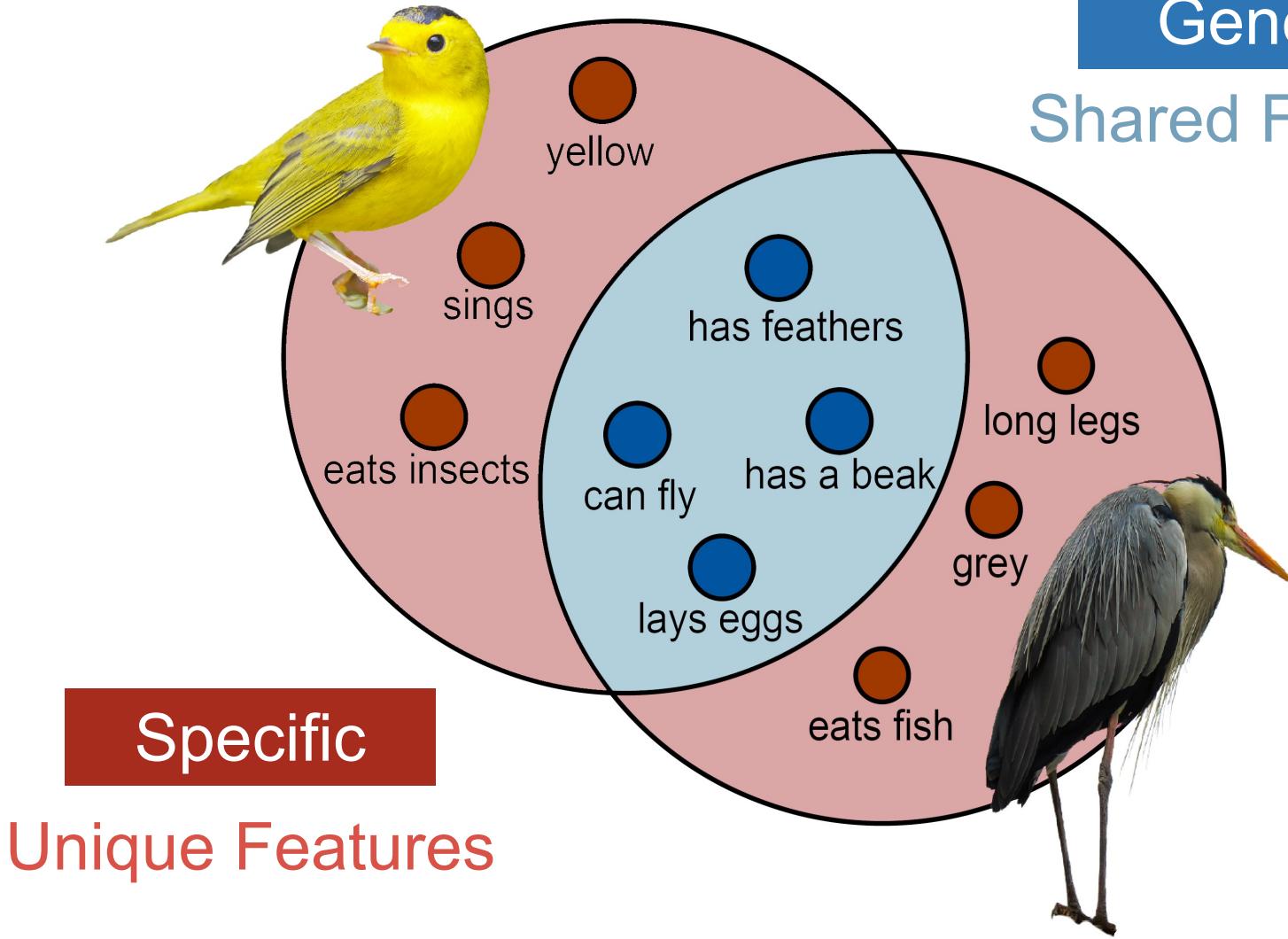
Penn Computational Cognitive
Neuroscience Lab



Penn
UNIVERSITY OF PENNSYLVANIA

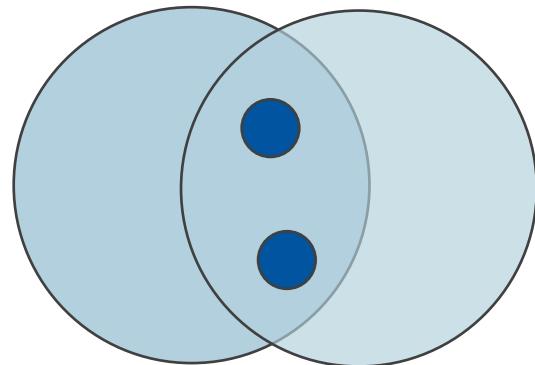


General
Shared Features

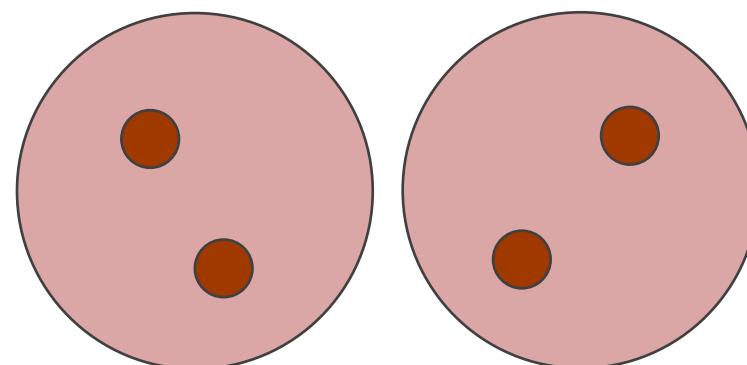


How are shared and **unique** features represented in memory?

Integrate

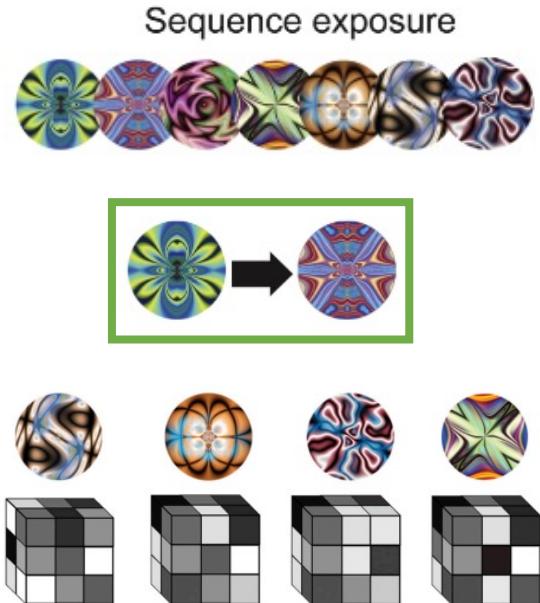


Separate



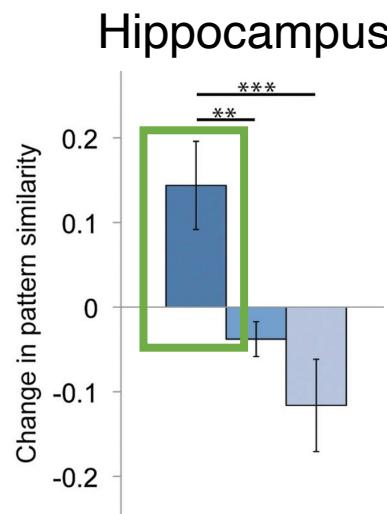
Items that “go together” have integrated neural representations

Statistical Learning



Concept Learning

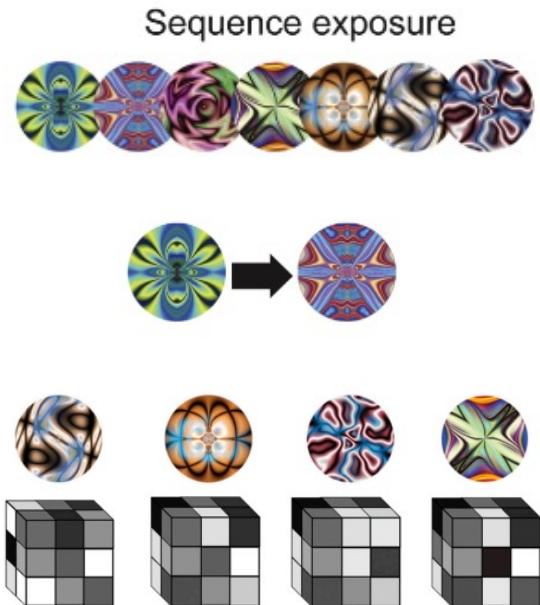
Shared features
“go together”
more than unique
features



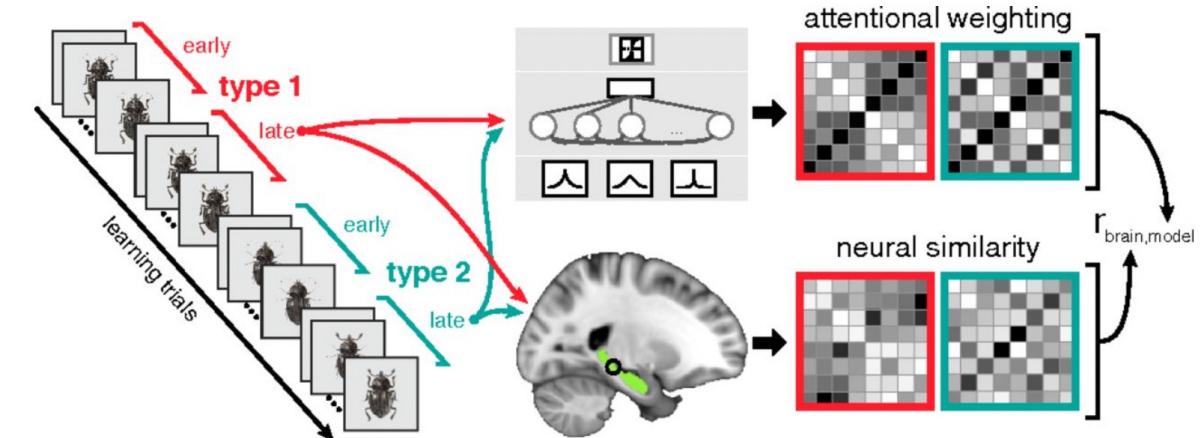
Schapiro et al. (2012, *Curr. Bio*)

Items that “go together” have integrated neural representations

Statistical Learning



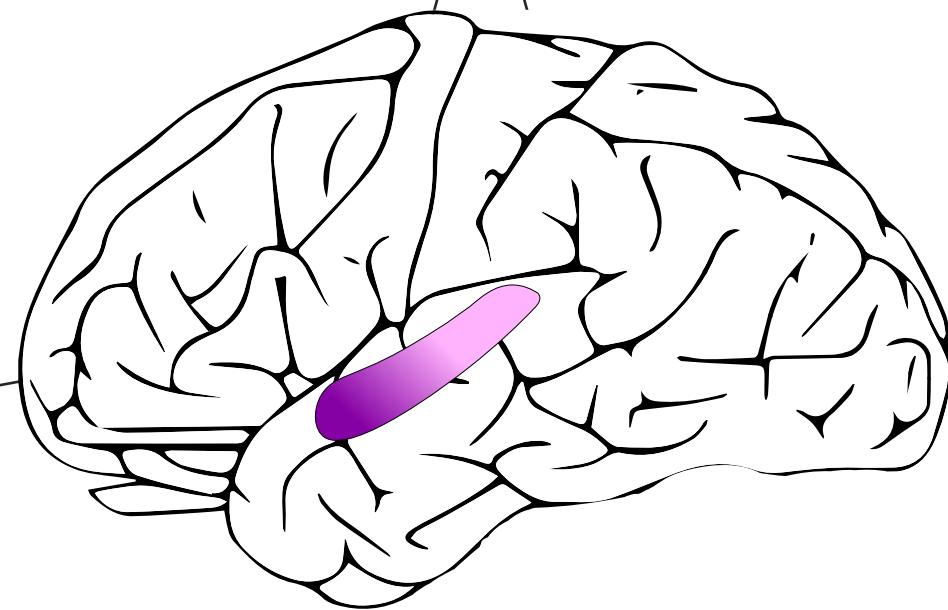
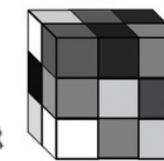
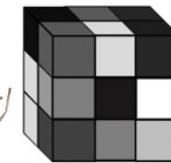
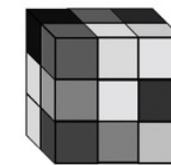
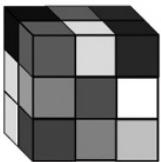
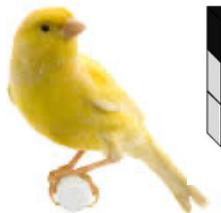
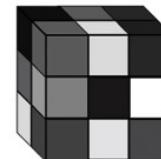
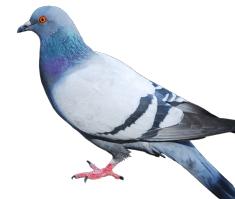
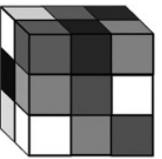
Concept Learning



Mack et al. (2016, *PNAS*)

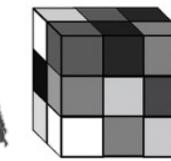
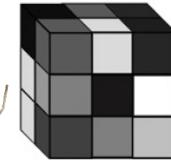
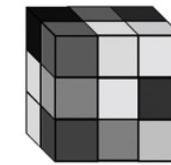
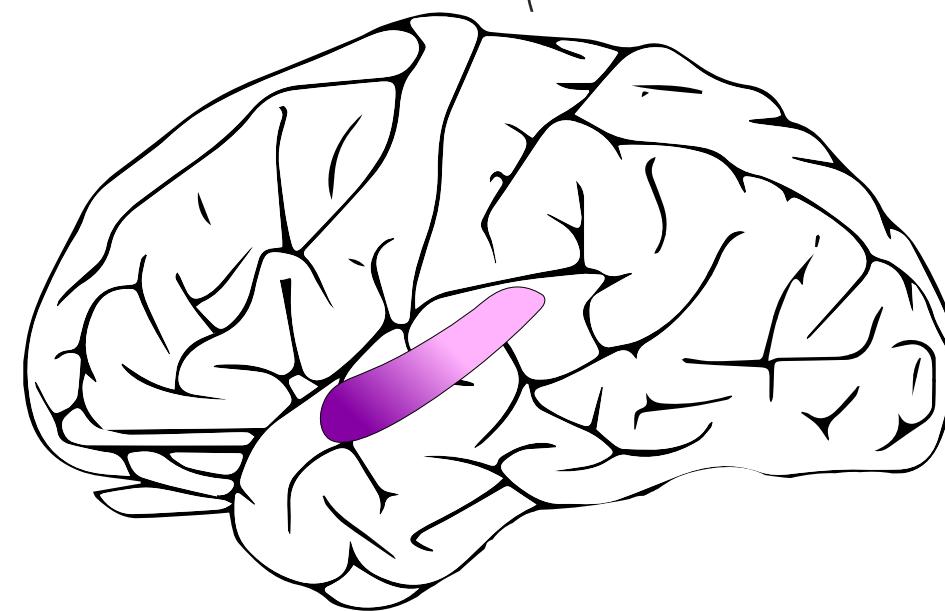
Item-Leve/
l

Feature-leve/
l

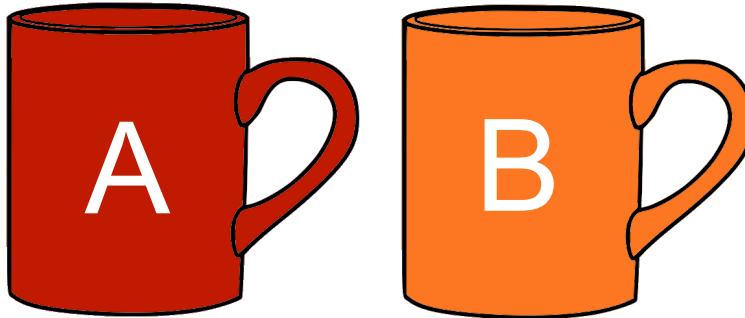


Memory distortions

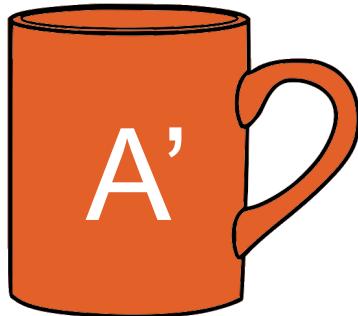
Feature-level



Distortions in color memory

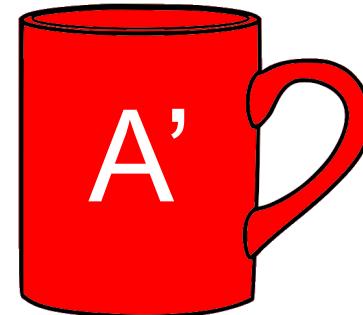


Attraction



Integration

Repulsion

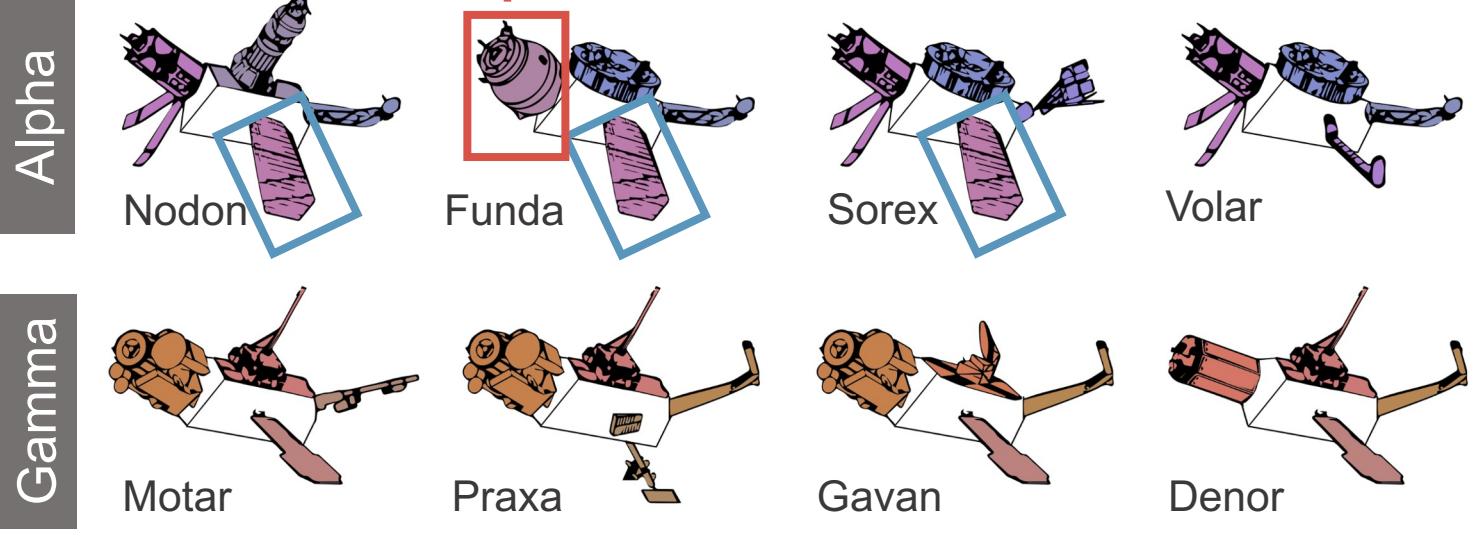


Separation

Design

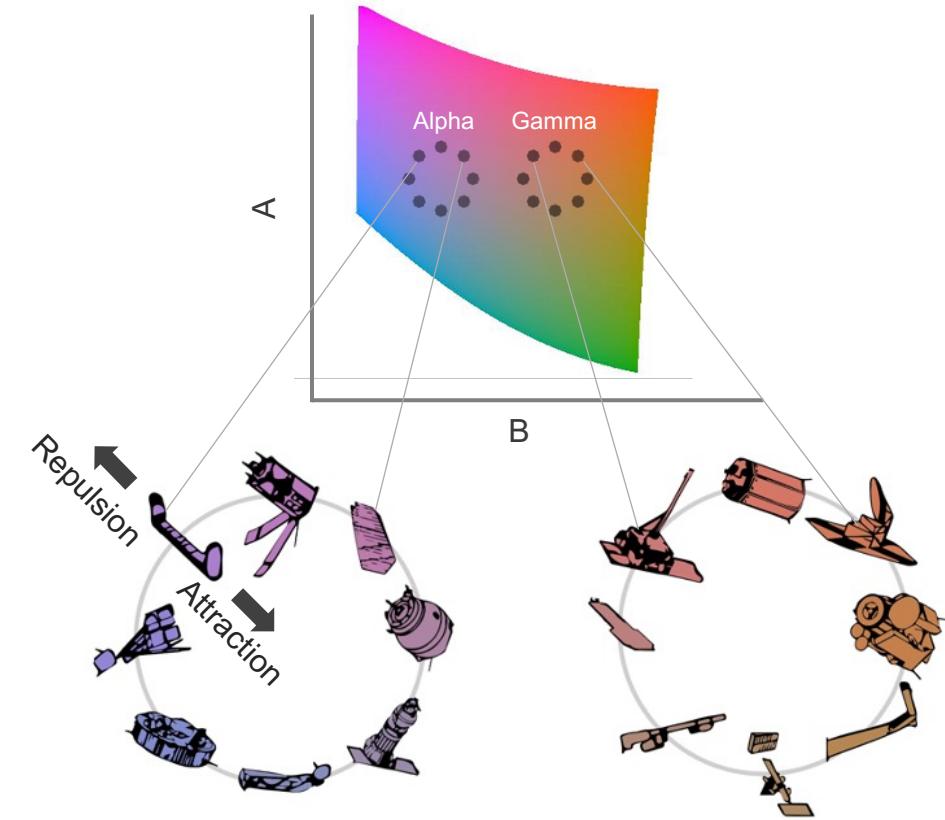
n = 85

Unique Shared



Items within a category share most parts (**shared** features)

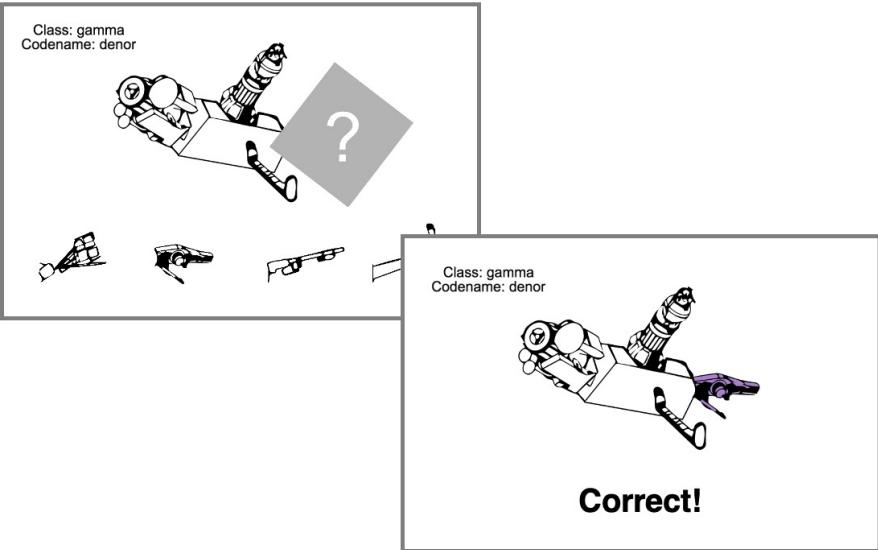
Each item has an individuating part (**unique** features)



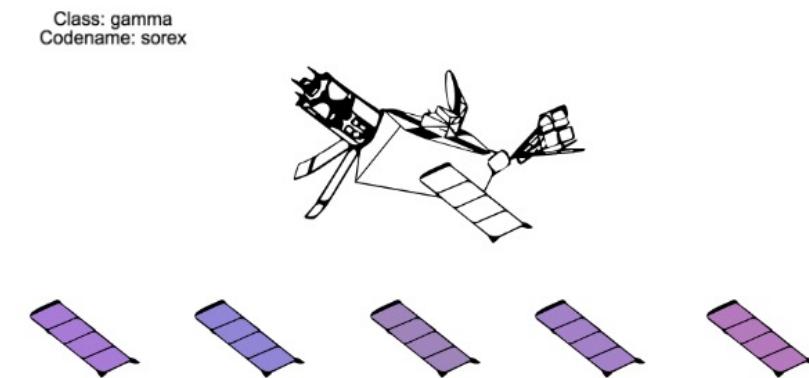
Attraction: Bias *towards* category features

Repulsion: Bias *away* from category features

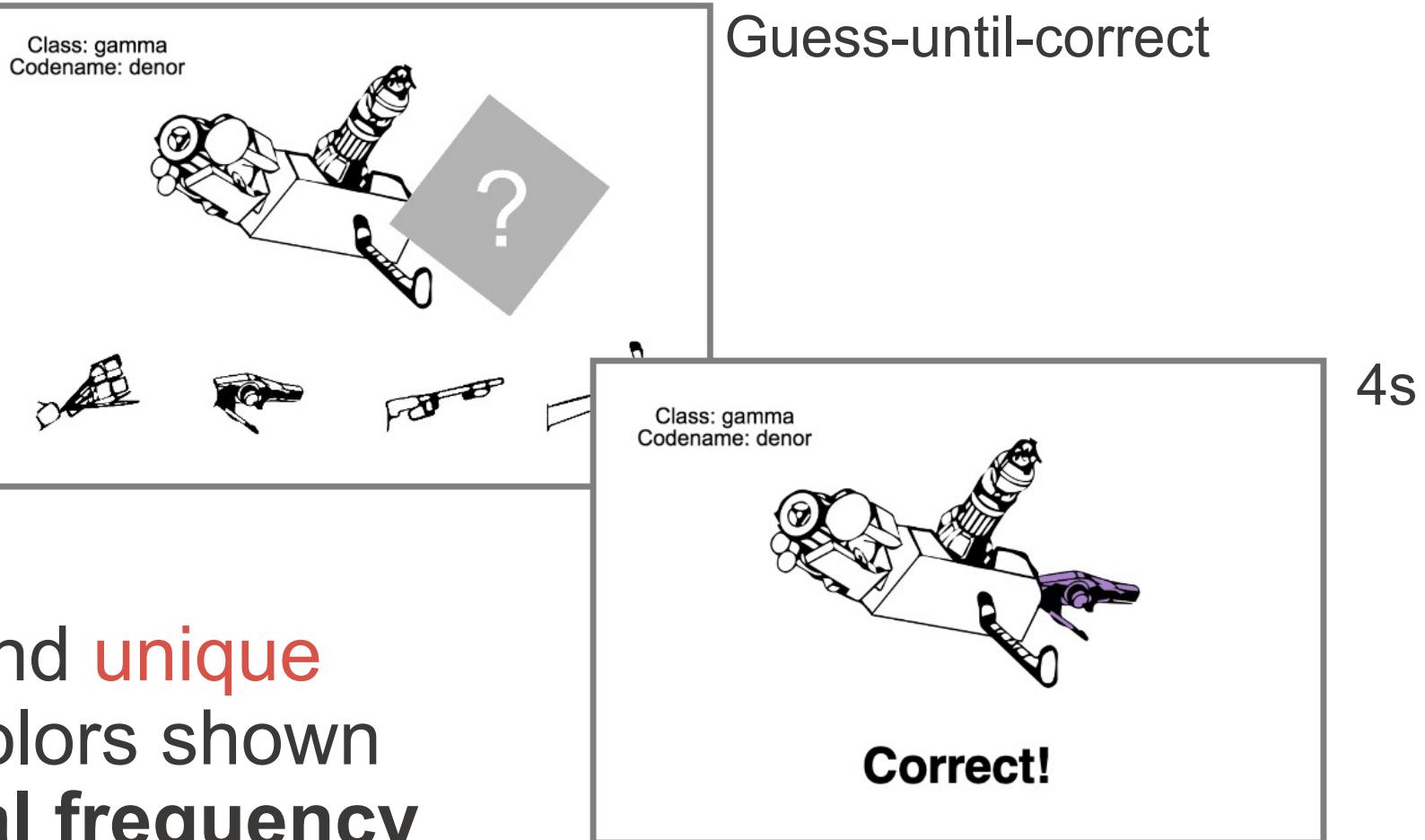
Part learning



Color memory test

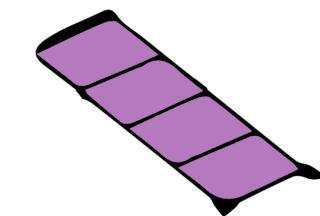
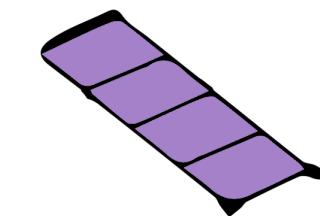
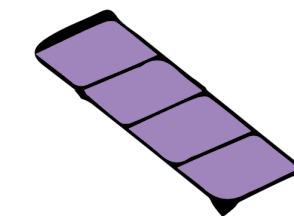
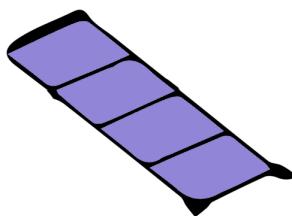
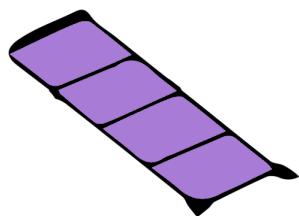
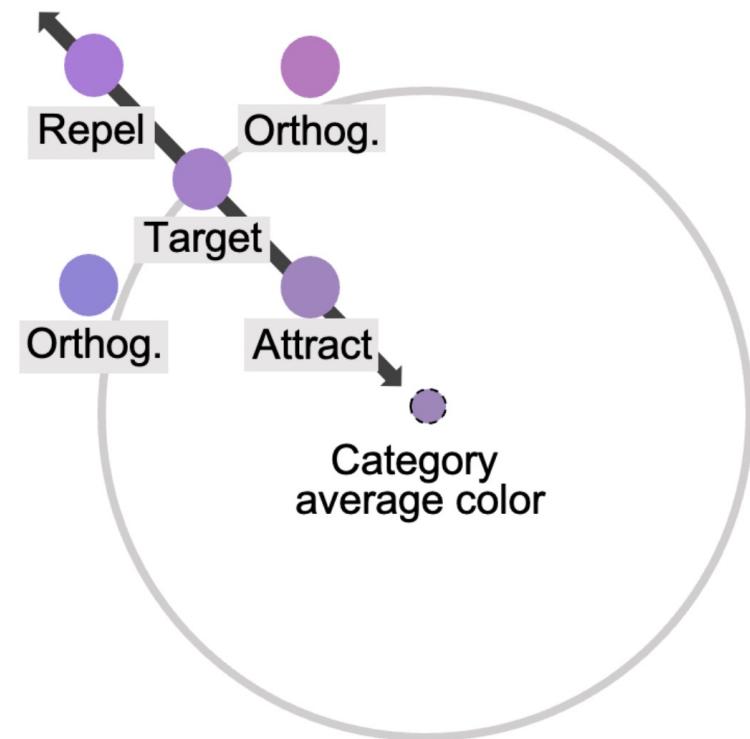
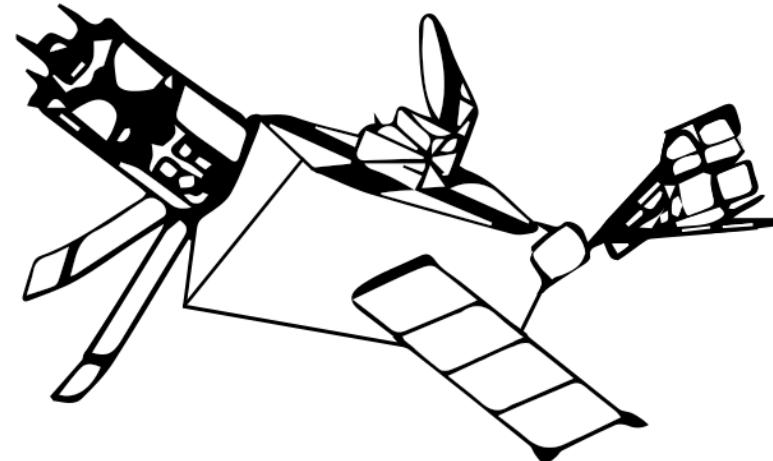


Part learning trial



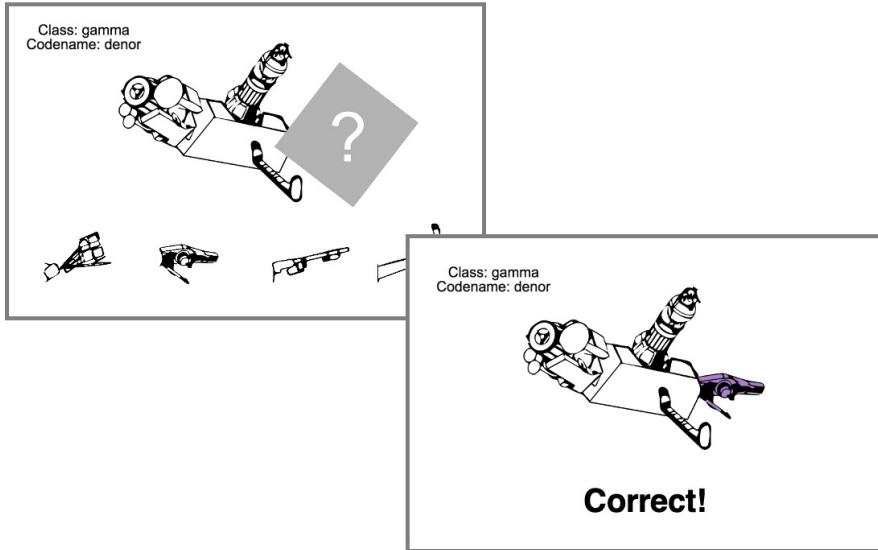
Color memory trial

Class: gamma
Codename: sorex

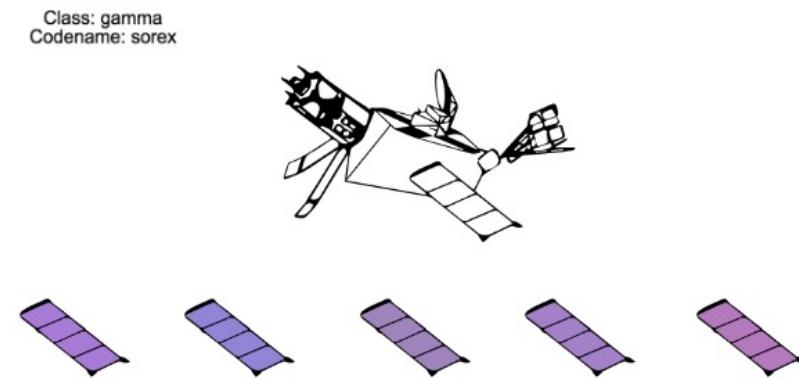


Continuously alternate between part learning and color memory

Part learning

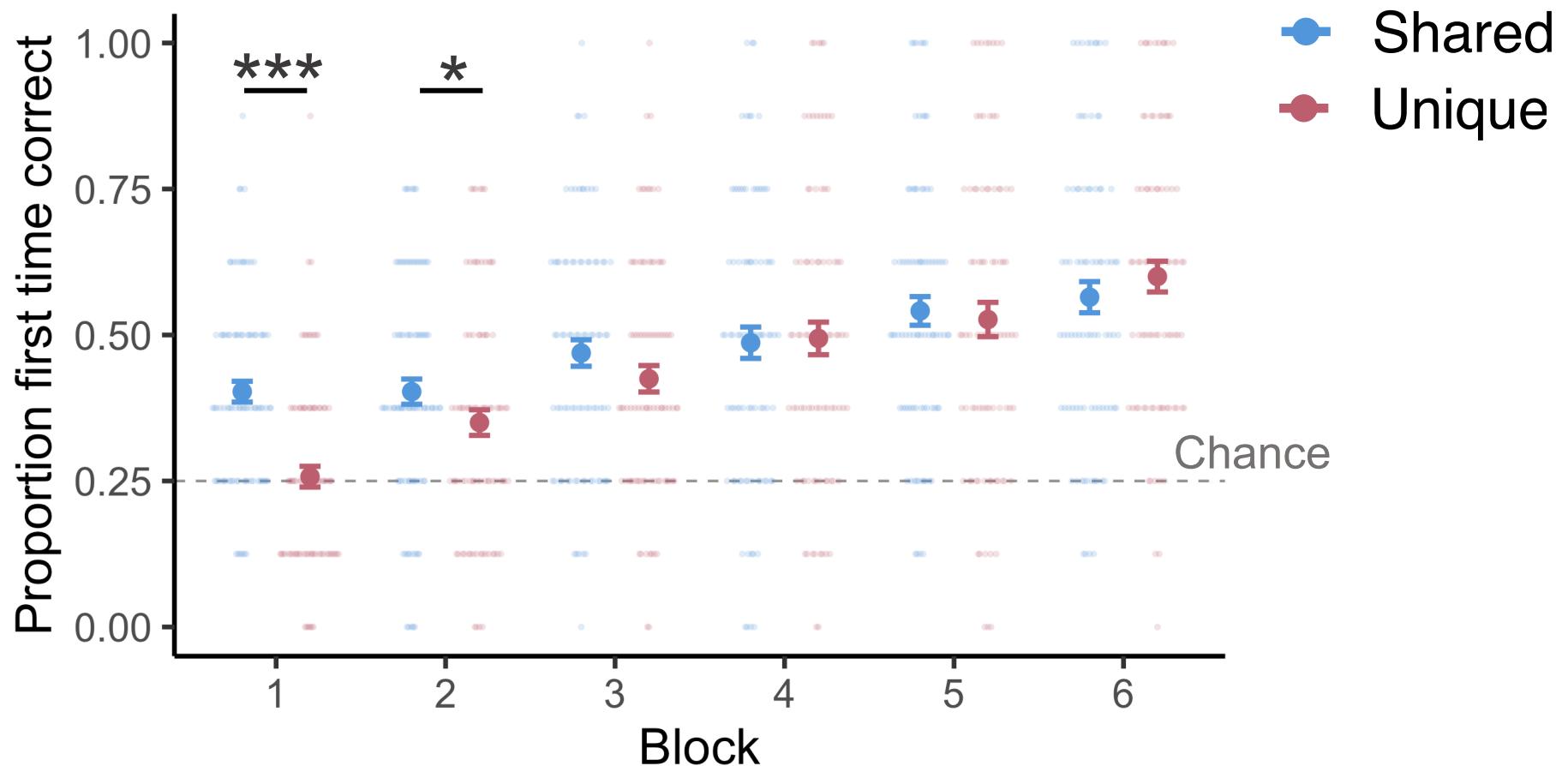


Color memory



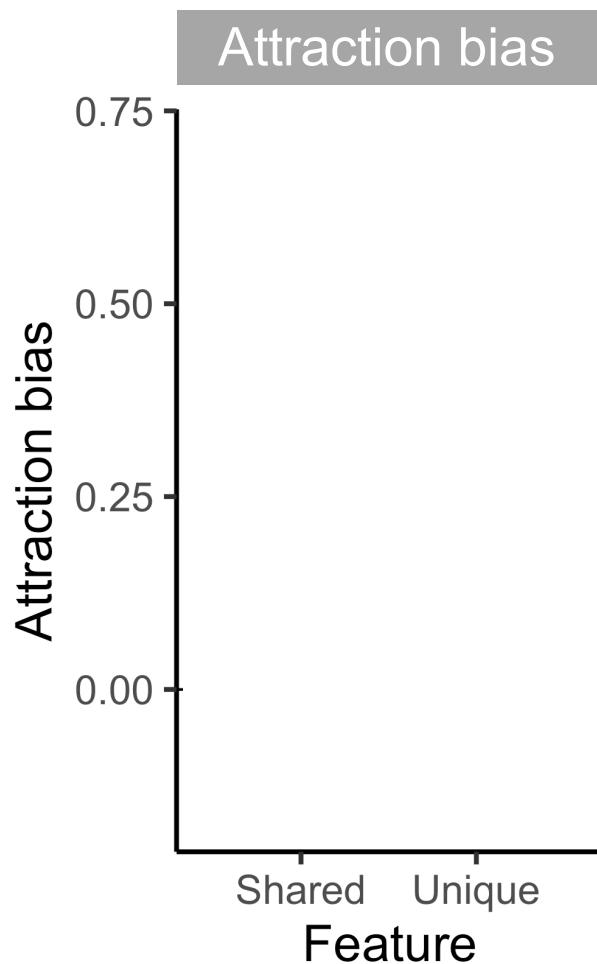
6 blocks (96 of each trial type total)

Part learning



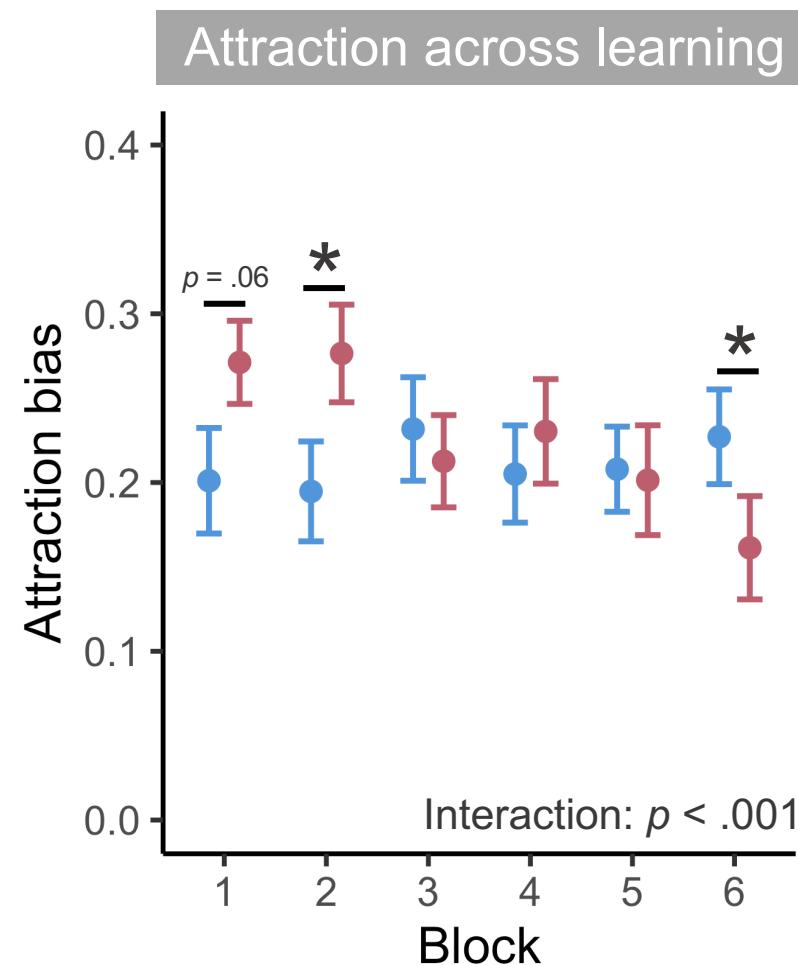
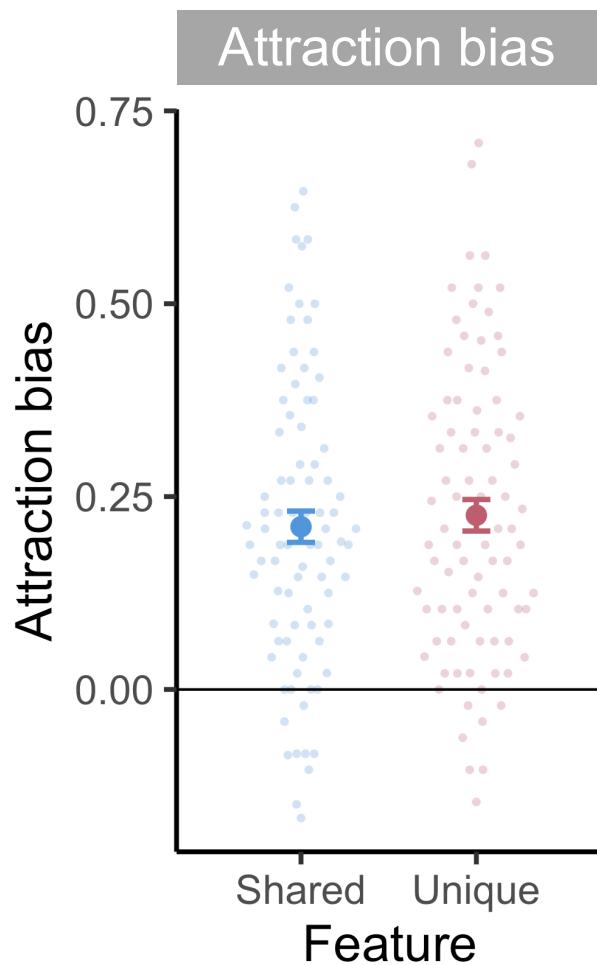
Color memory

● Shared ● Unique



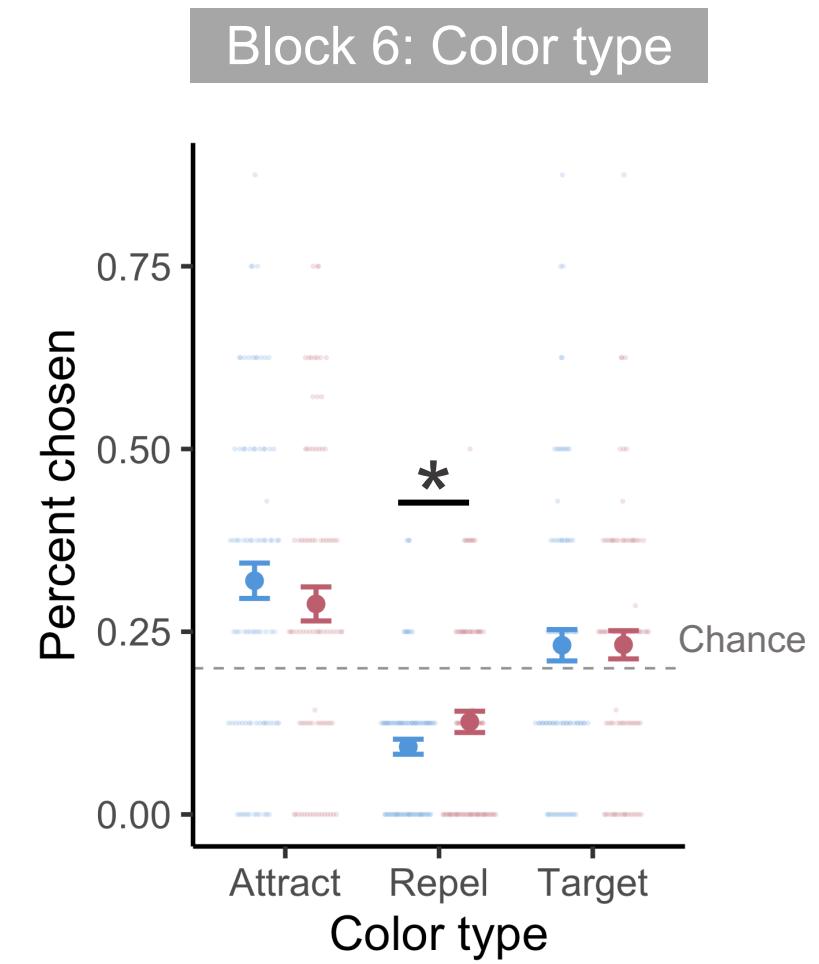
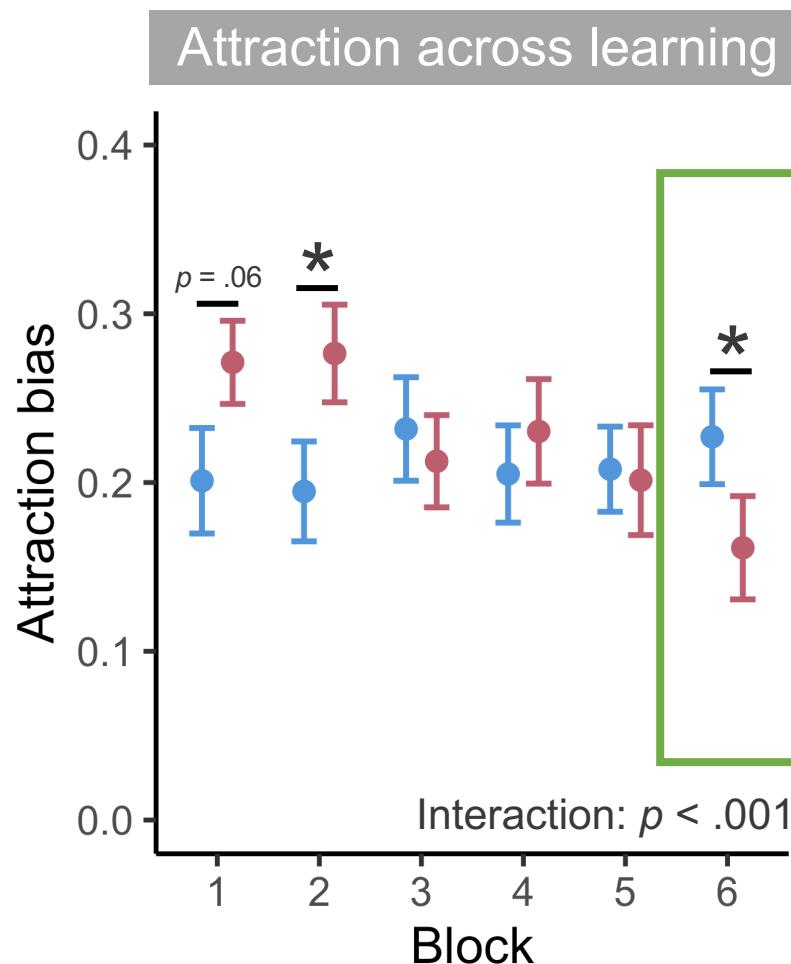
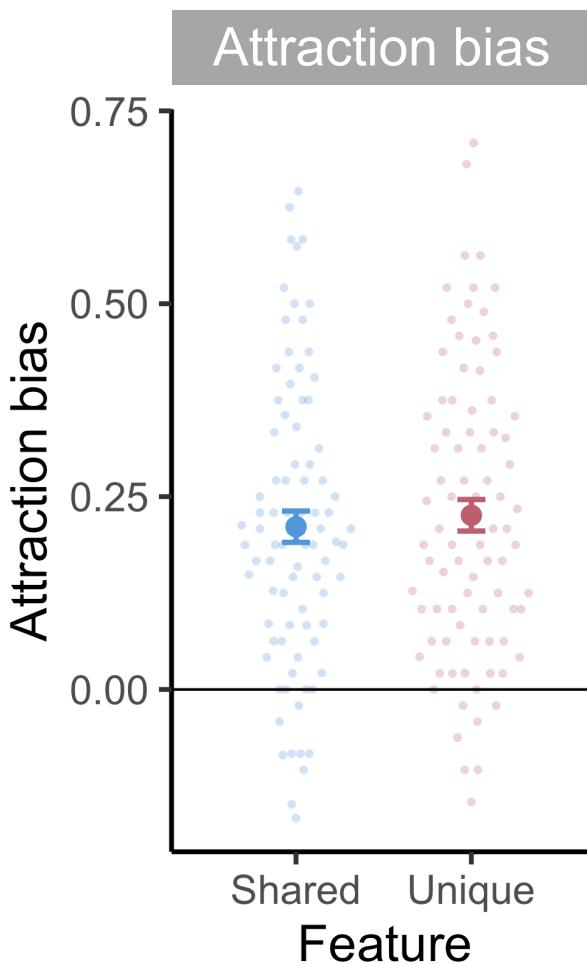
Color memory

● Shared ● Unique



Color memory

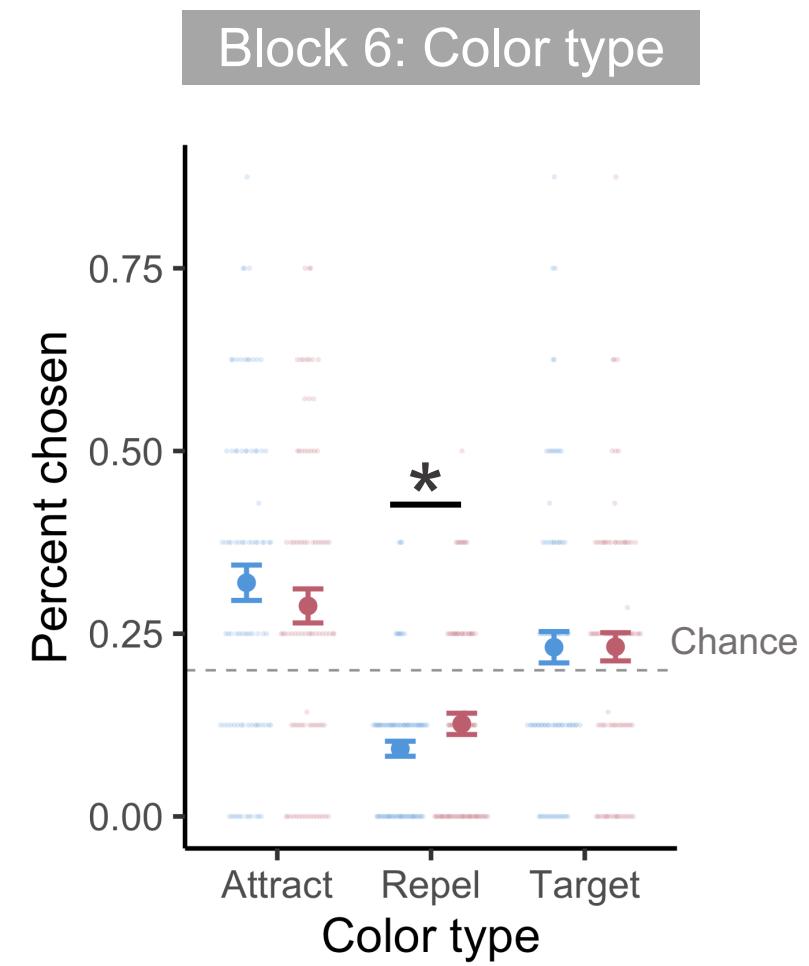
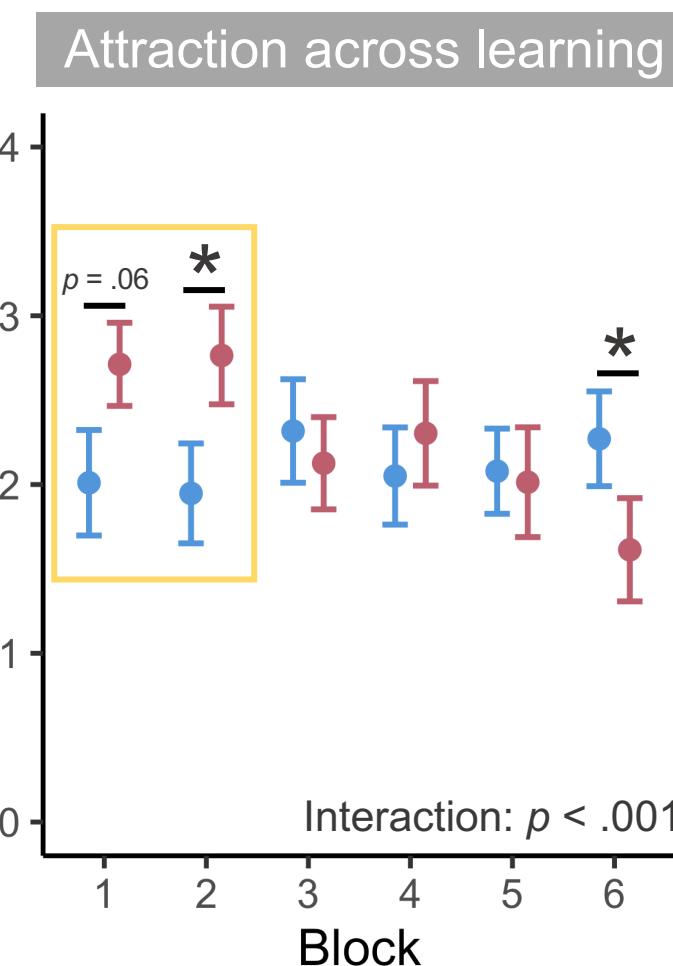
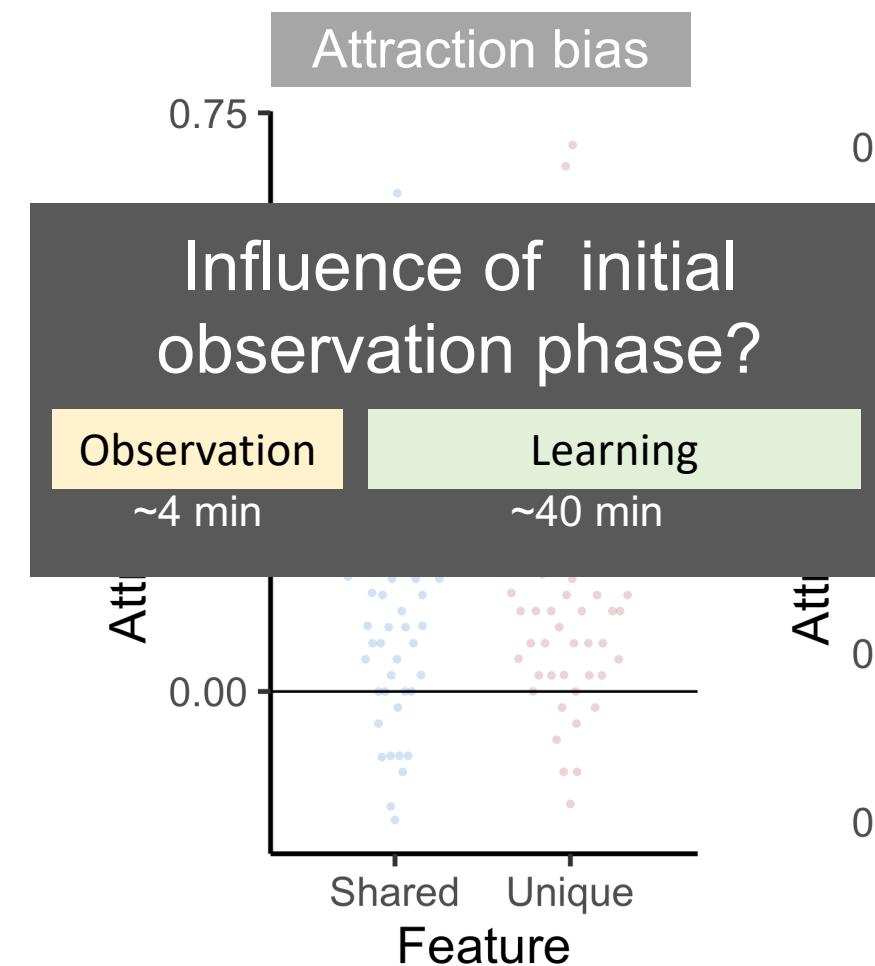
● Shared ● Unique



Unique features show less attraction with learning

Color memory

● Shared ● Unique

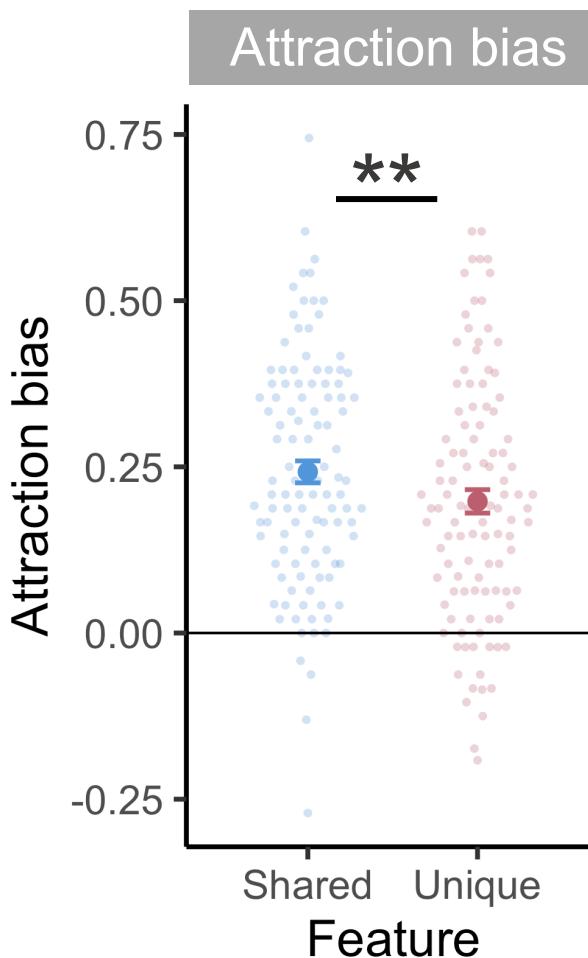


Unique features show less attraction with learning

Replication study (matched color frequency during early observation)

n = 109

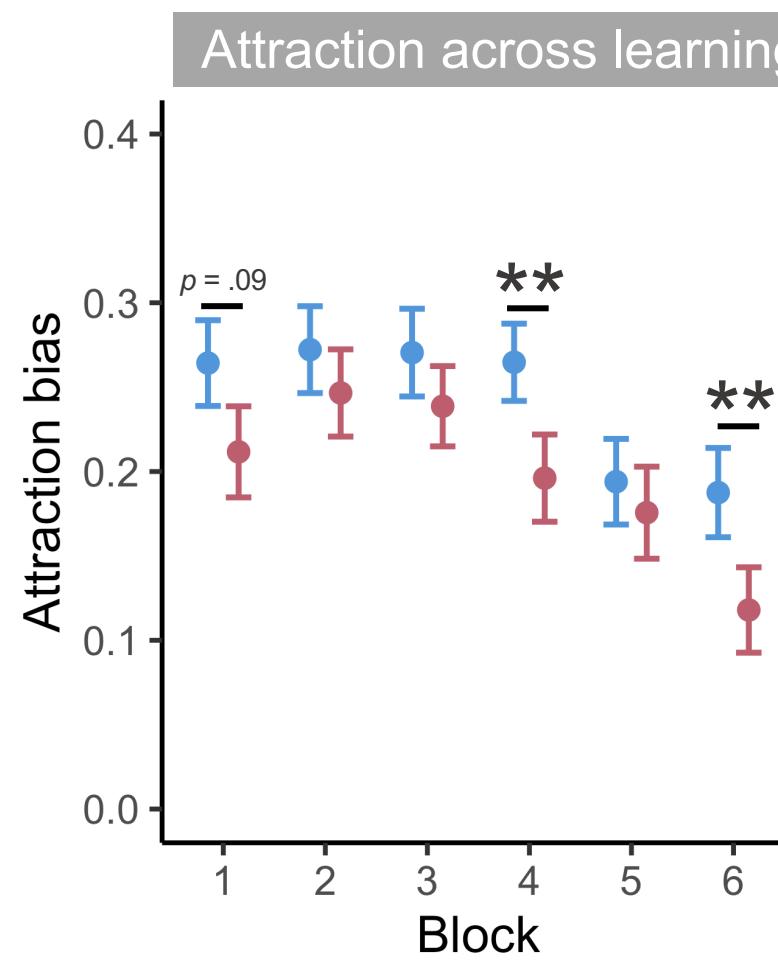
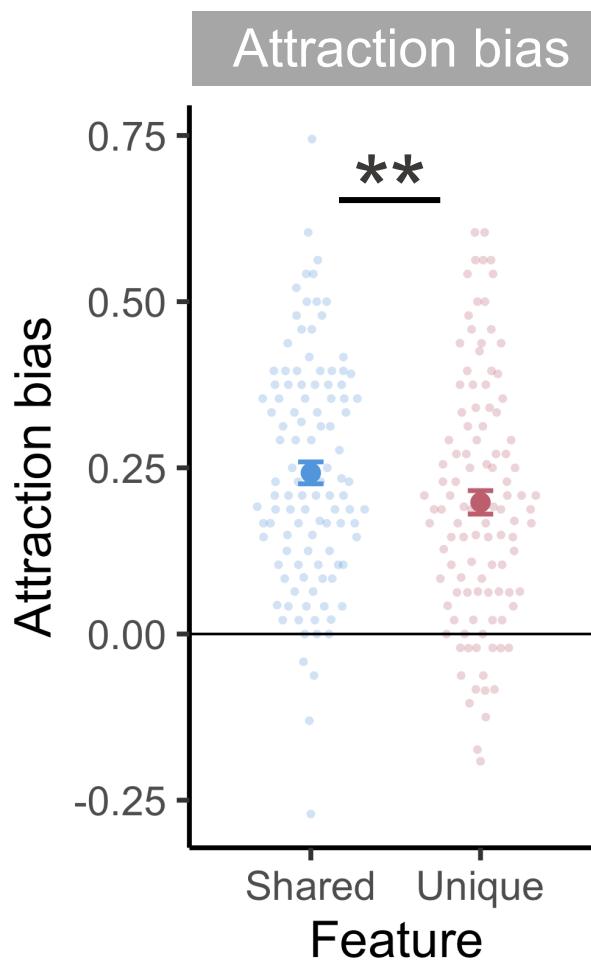
● Shared ● Unique



Replication study (matched color frequency during early observation)

n = 109

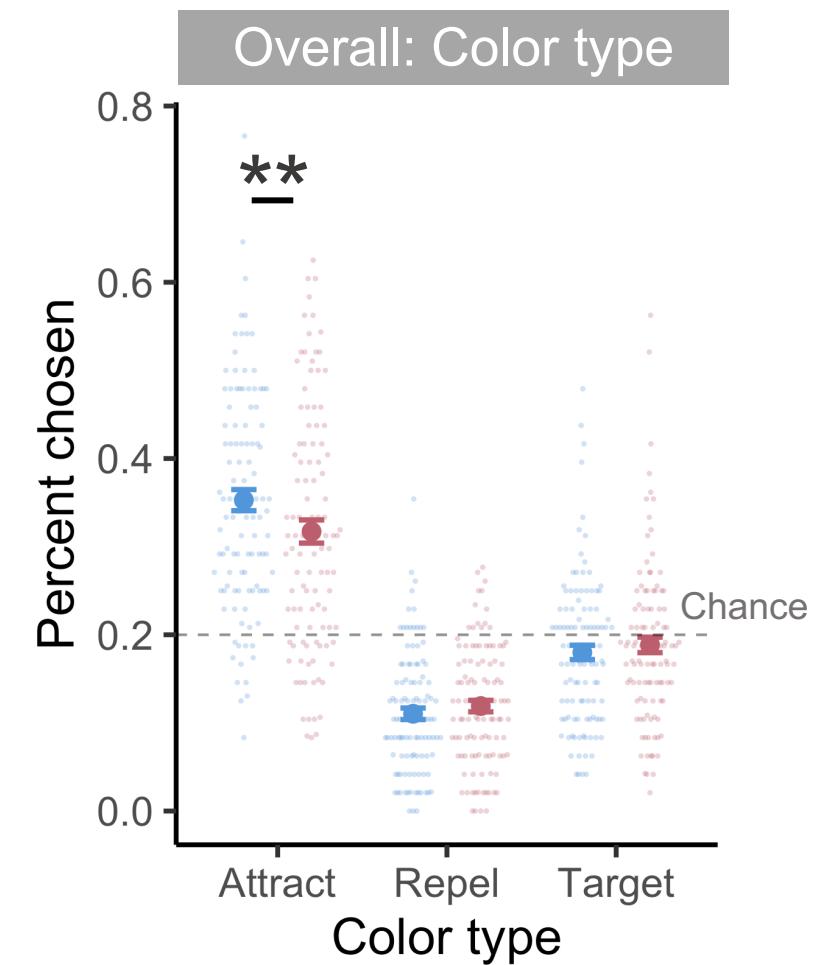
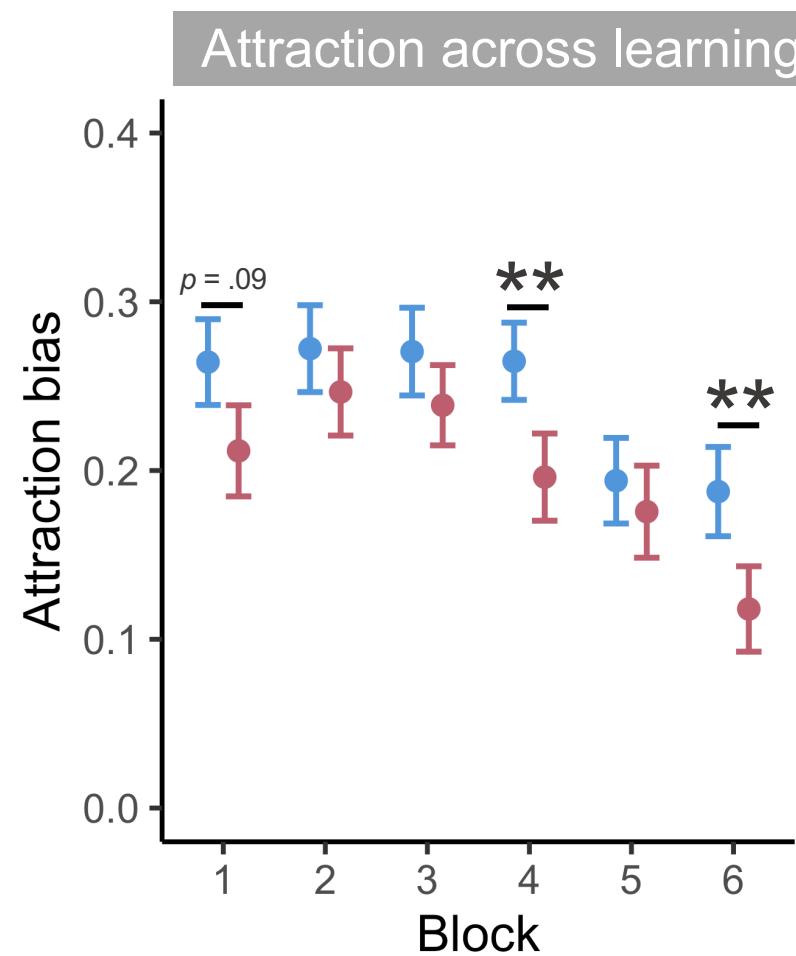
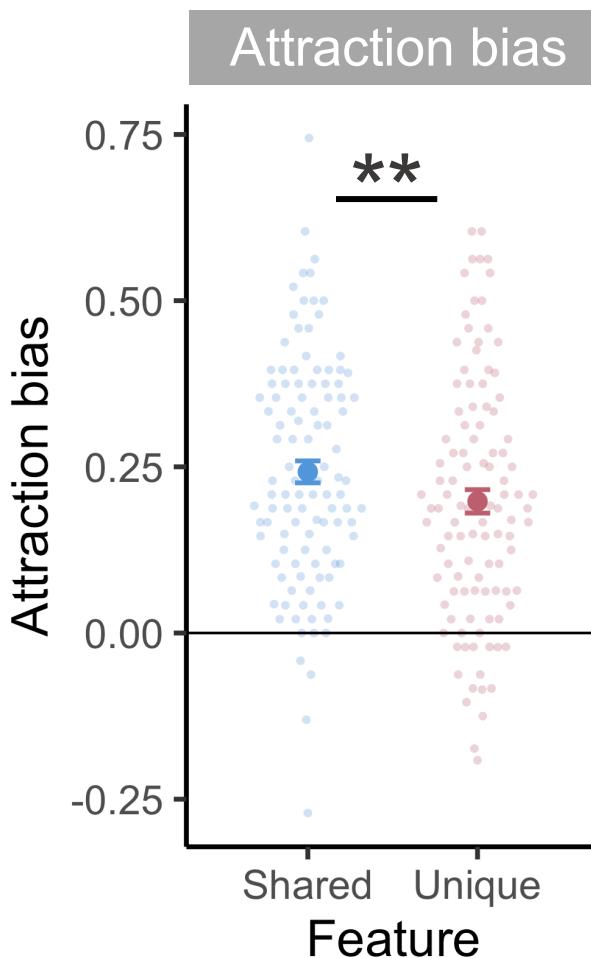
● Shared ● Unique



Replication study (matched color frequency during initial observation)

n = 109

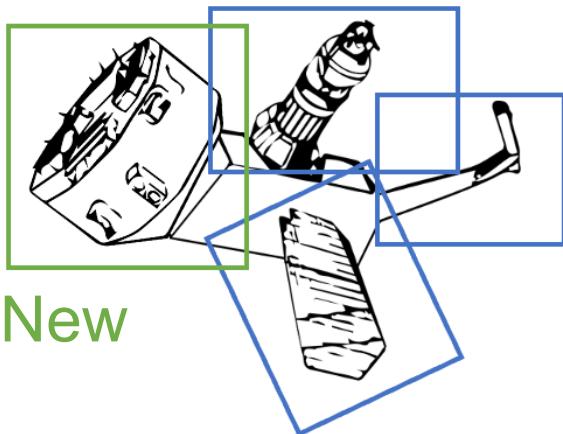
● Shared ● Unique



Stronger attraction bias overall for **shared features**

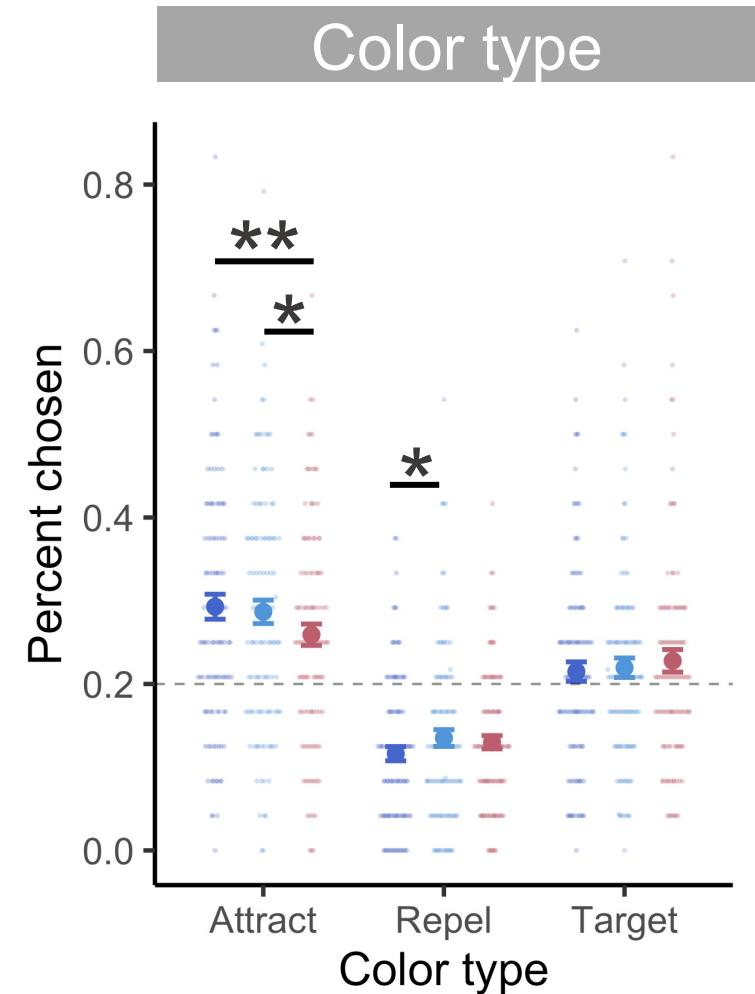
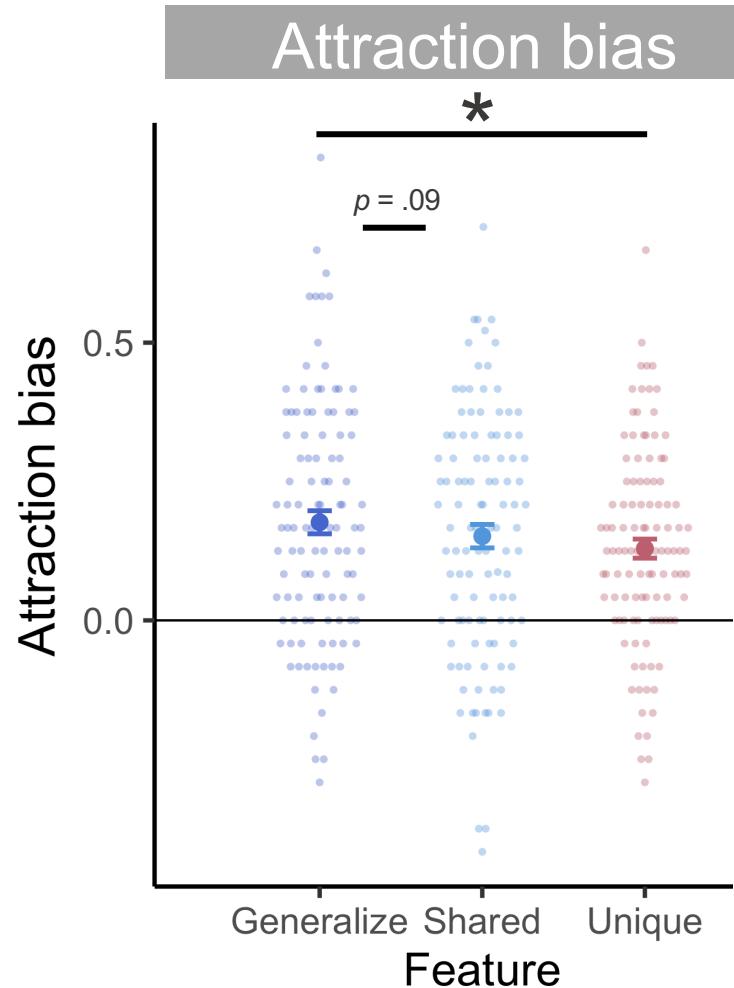
Post-learning: Generalization

Novel satellite



New

Shared parts, but on
novel satellites
(generalize)



Strong attraction for **shared features** on novel exemplars

Shared features are more susceptible to category-based memory distortions than unique features

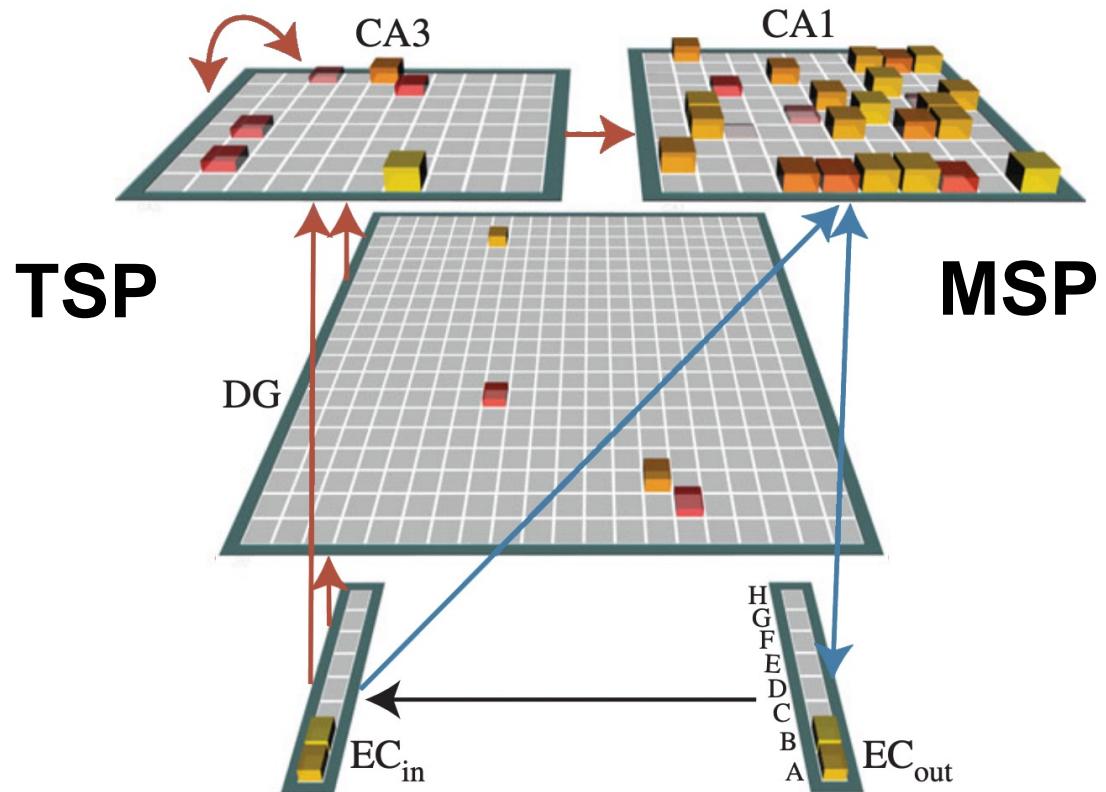
Shared features may have more integrated memory representations than unique features

Feature representations in a neural network model



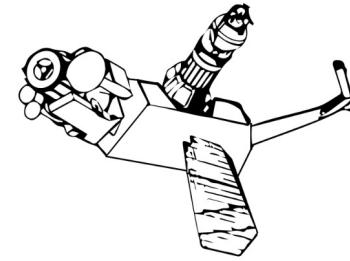
C-HORSE

Complementary hippocampal operations
for representing **statistics** and **episodes**



Schapiro et al. (2017)

Train model
on satellites

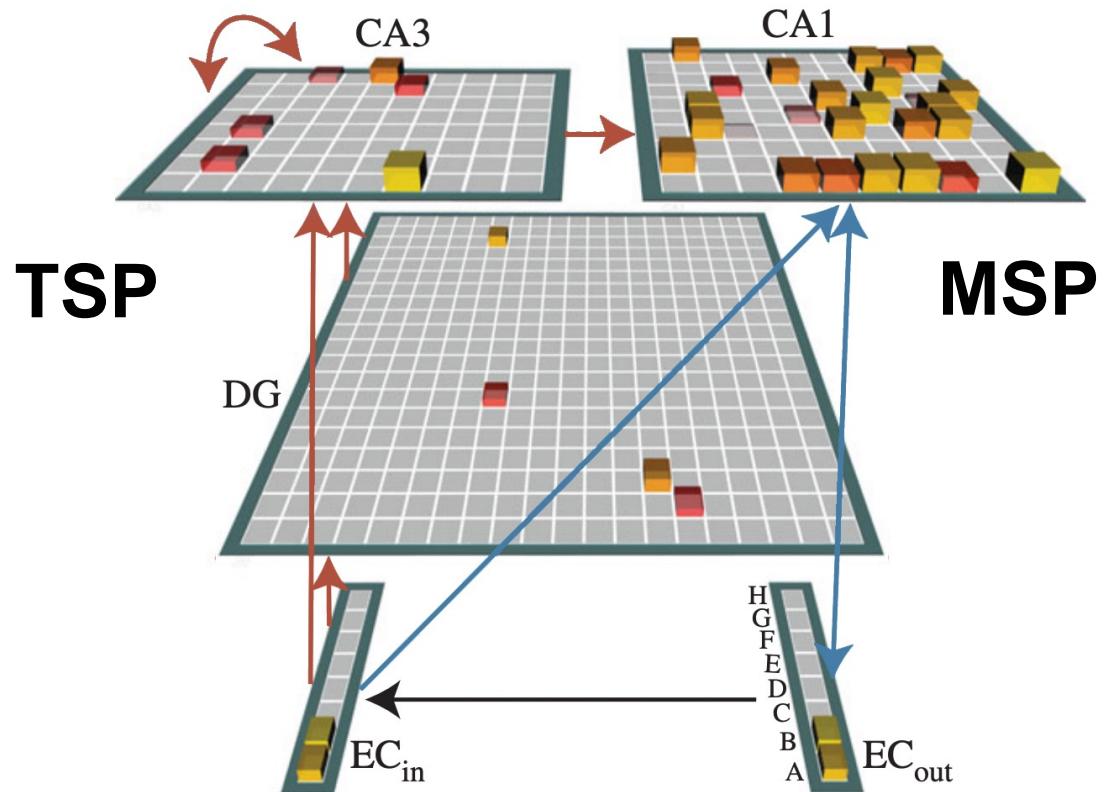


Feature representations in a neural network model



C-HORSE

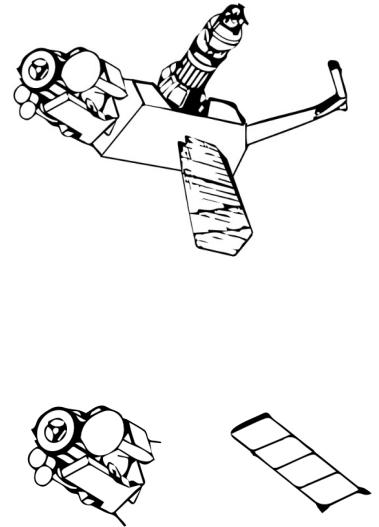
Complementary hippocampal operations
for representing **statistics** and **episodes**



Schapiro et al. (2017)

Train model
on satellites

Present features
one-by-one

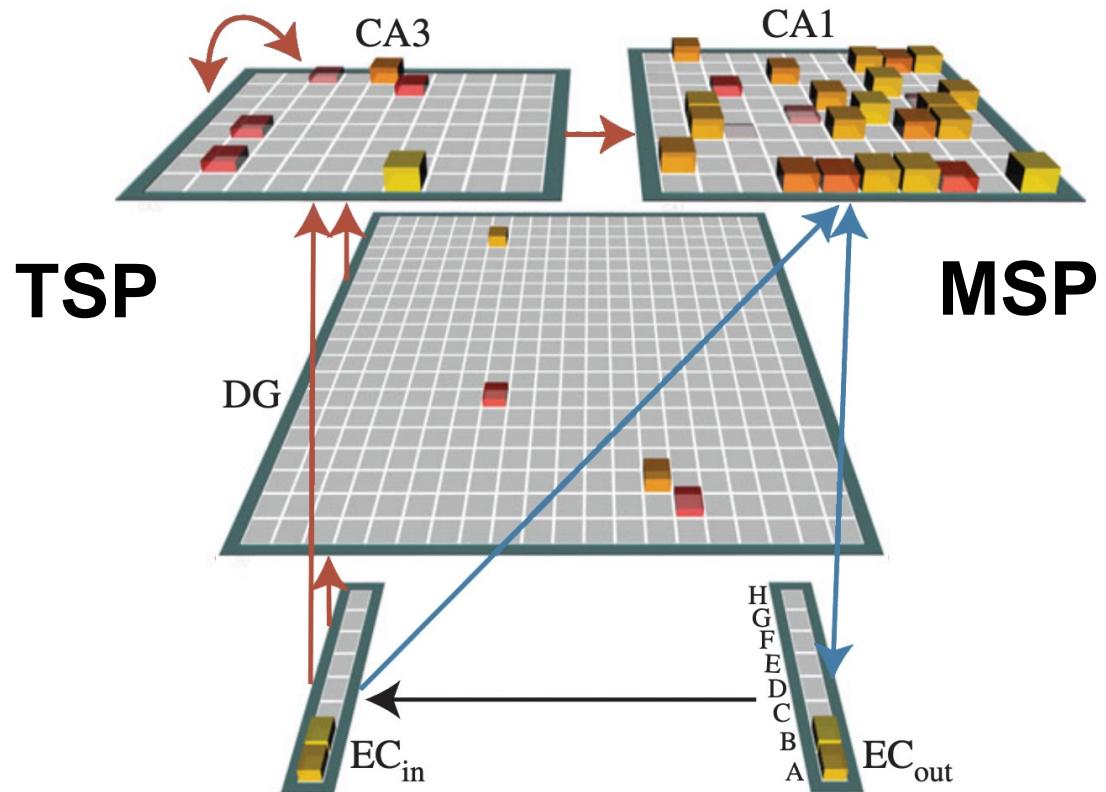


Feature representations in a neural network model



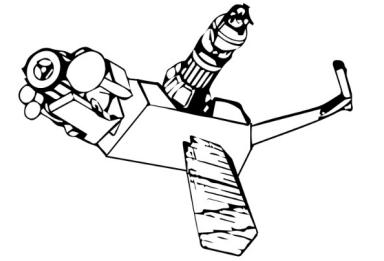
C-HORSE

Complementary hippocampal operations
for representing **statistics** and **episodes**



Schapiro et al. (2017)

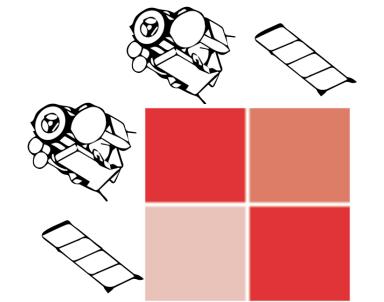
Train model
on satellites



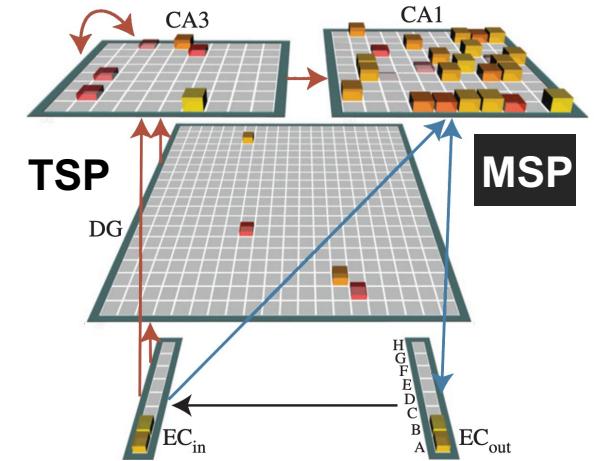
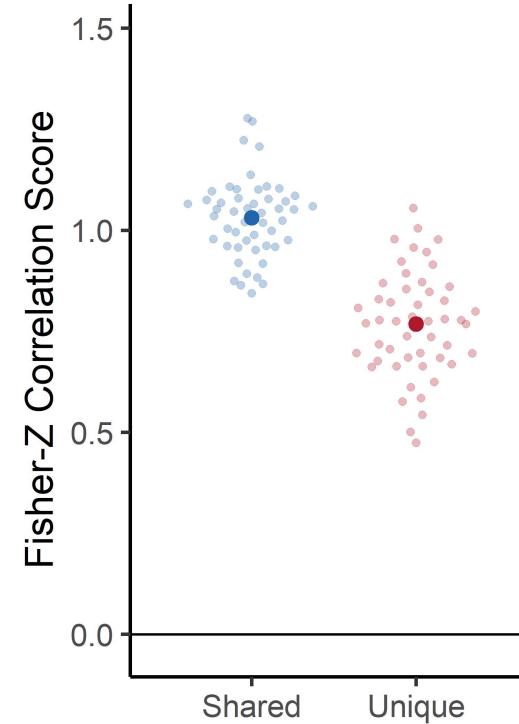
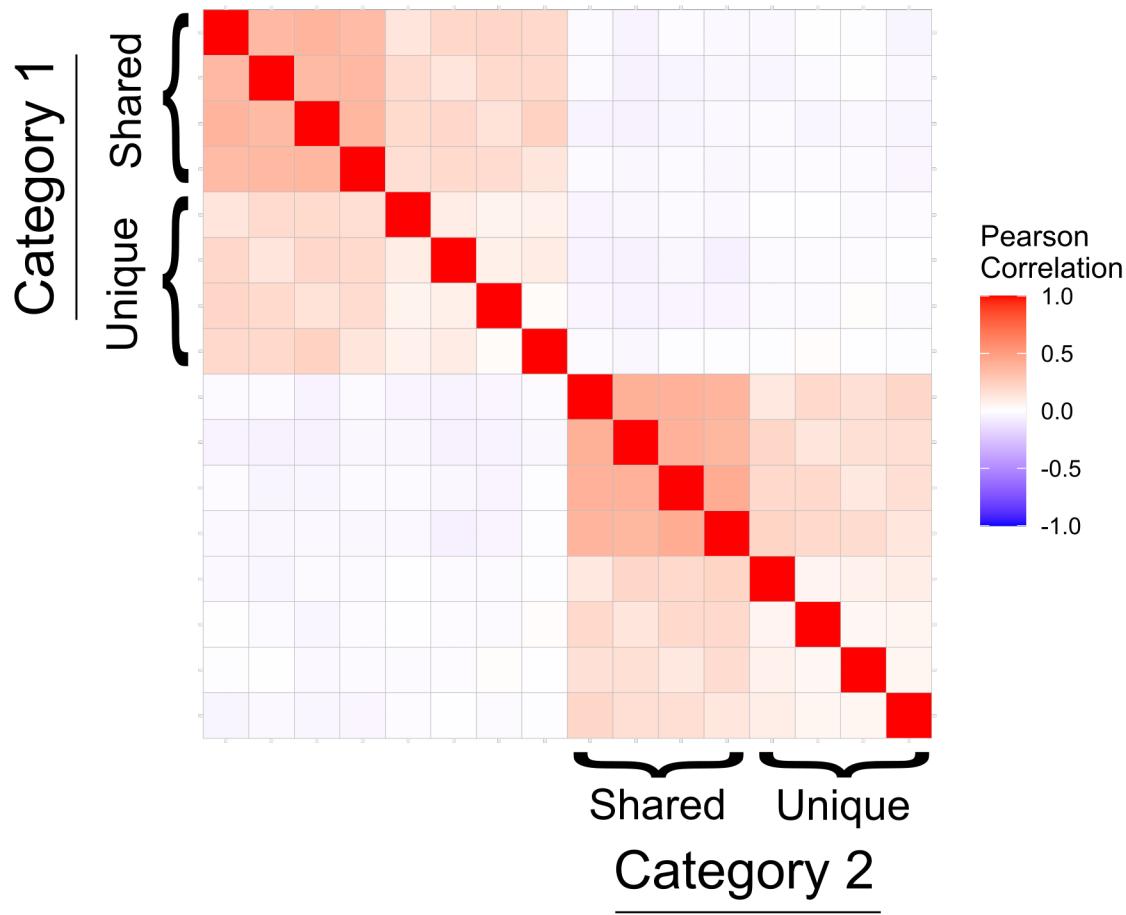
Present features
one-by-one



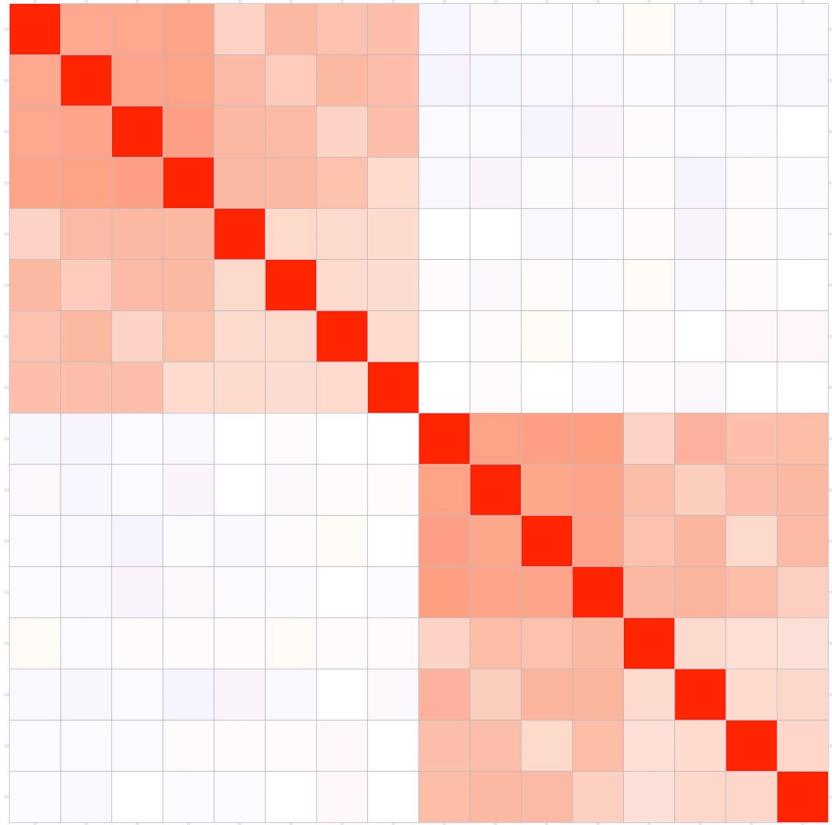
Calculate pattern
similarity between
all features



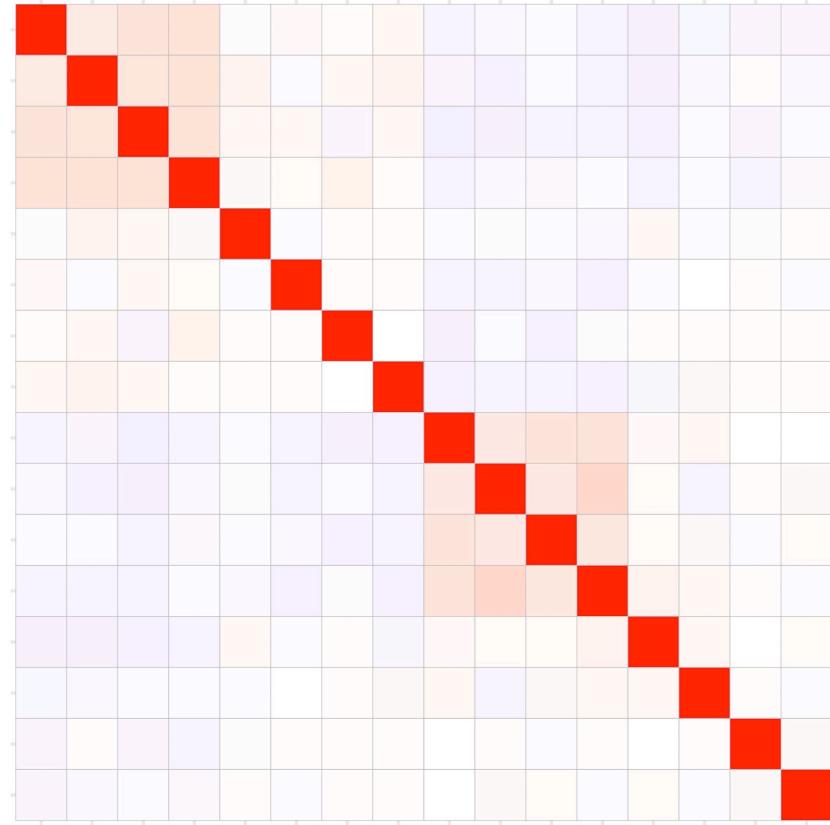
Feature representations in a neural network model



TSP lesion



MSP lesion



Shared and **unique** features are represented in memory according to their different computational-needs

