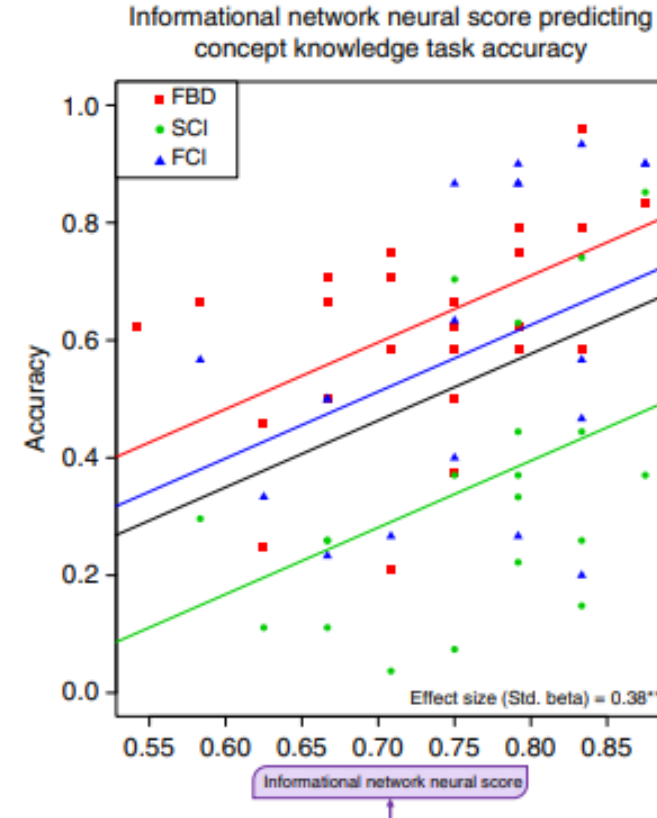
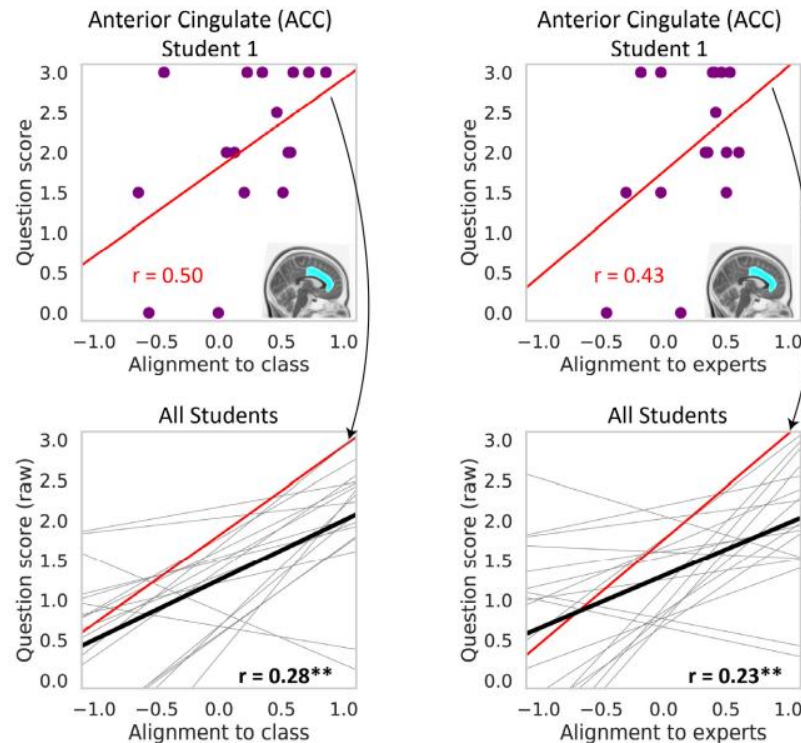


Decoding knowledge of newly-learned language from neural representations of semantic meaning

Megan Hillis
Cognitive Neuroscience Society
Data Blitz Session 2

Neural correlates of newly-acquired knowledge

- Neural alignment to class predicts Intro Computer Science final exam performance
- Mechanical category separability in neural data predicts concept-relevant task scores



Meshulam, M., Hasenfratz, L., Hillman, H., Liu, Y.-F., Nguyen, M., Norman, K. A., & Hasson, U. (2020). Think Like an Expert: Neural Alignment Predicts Understanding in Students Taking an Introduction to Computer Science Course. *BioRxiv*, 2020.05.05.079384

*Cetron, J. S., Connolly, A. C., Diamond, S. G., May, V. V., Haxby, J. V., & Kraemer, D. J. M. (2019). Decoding individual differences in STEM learning from functional MRI data. *Nature Communications*, 10(1), 2027

Pilot Study

- Participants: 20 English-speaking undergraduates
- Stimuli:



ASL



Russian



English

“козел”

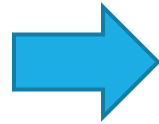
“goat”

	Animals	Fruits	Vehicles
goat			
hen			
mouse			
turtle			
cherry			
coconut			
peach			
strawberry			
airplane			
bus			
sailboat			
truck			

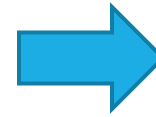


Pilot Study: Procedure

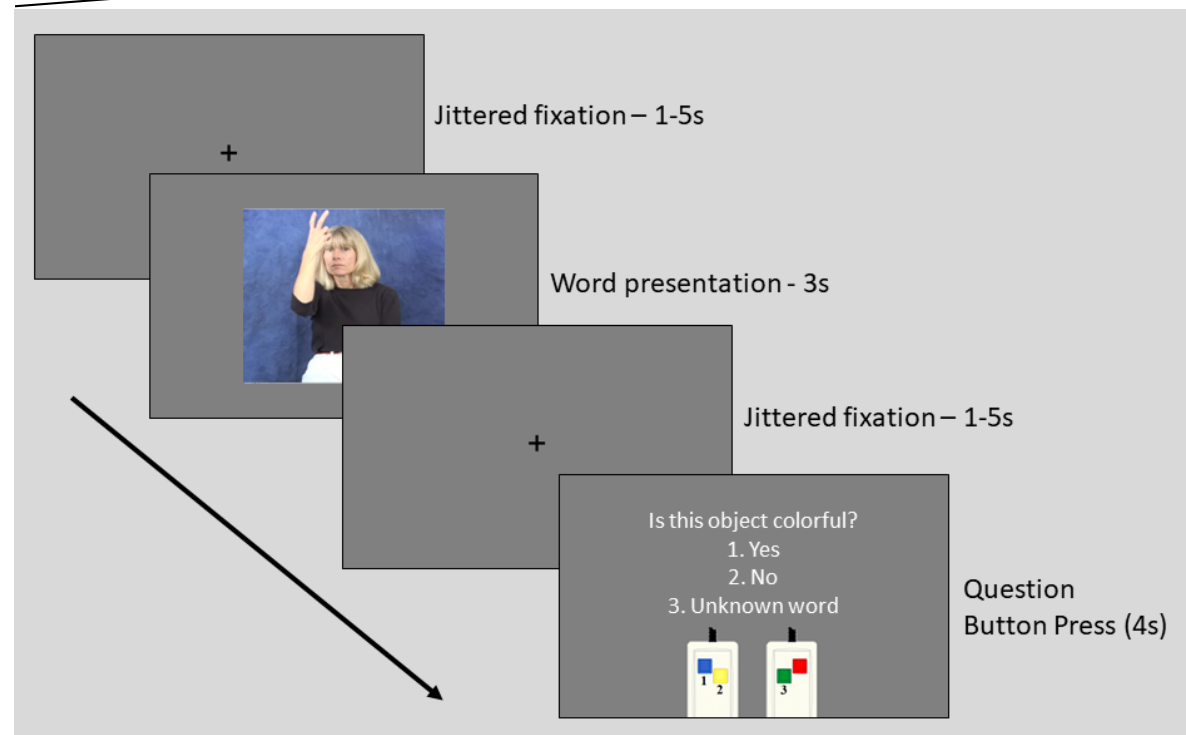
Day 1:
Online Lesson
(30 min)



Day 2:
Online Lesson
(30 min)

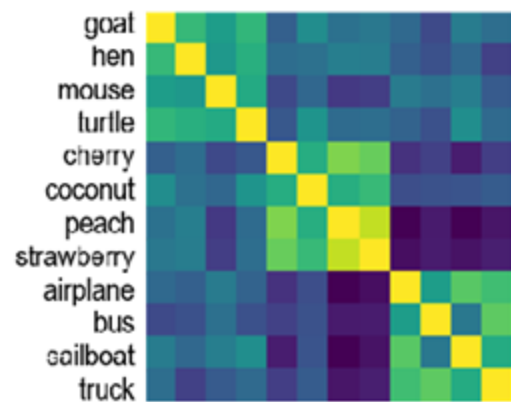


Day 3:
Online review
(30 min),
fMRI Scan

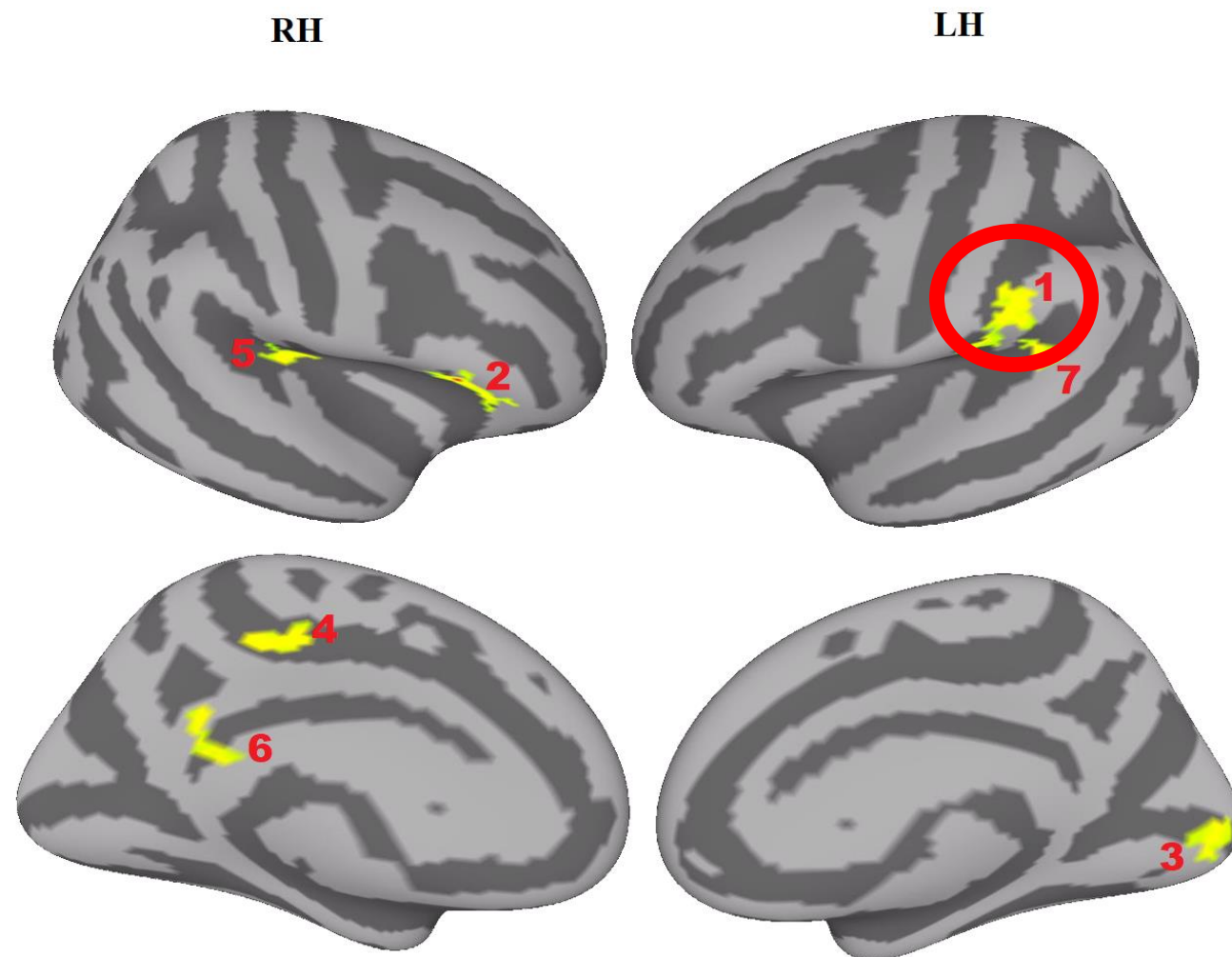


Pilot Study: Neural Results (ASL Group)

- Representational Similarity Analysis of **English trials only**
- 7 Clusters significantly correlated with Word2Vec model

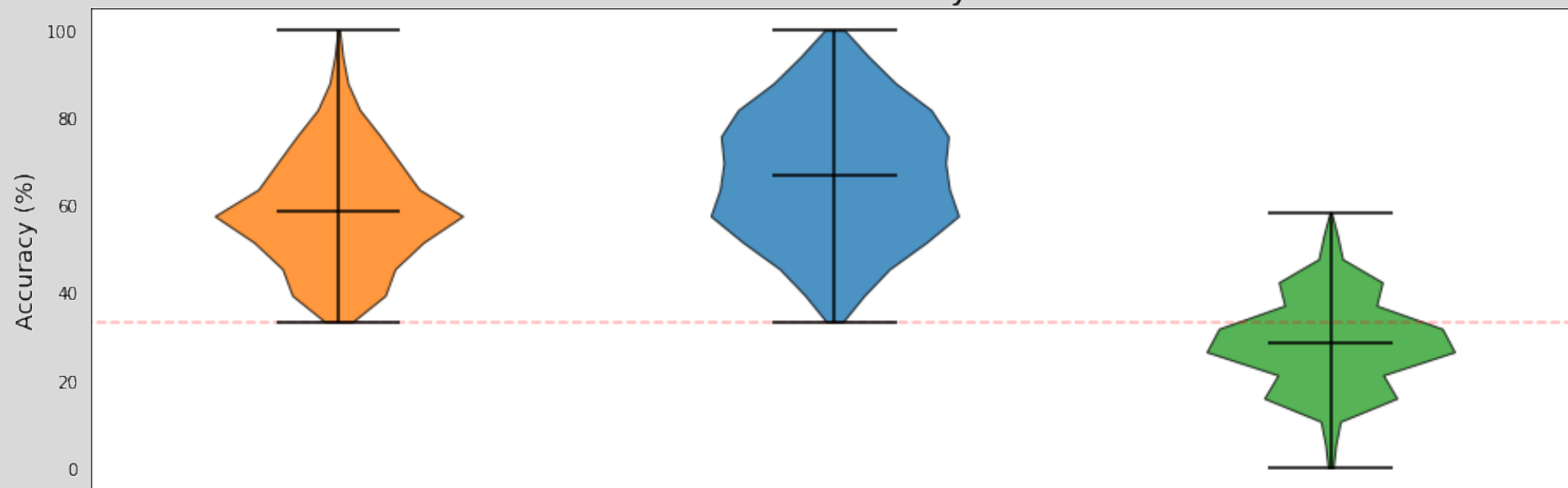


$t = 6.97$

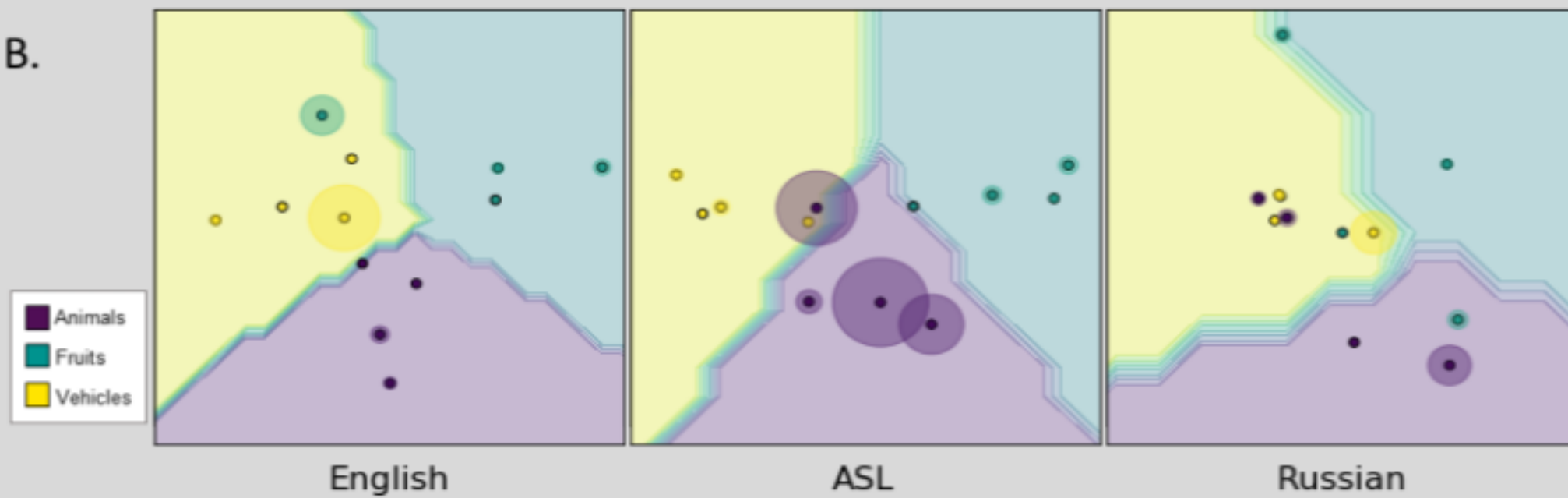


SVM Classification Accuracy in Cluster 1

A.



B.



Fall 2023 Study

- To assess individual differences in learning:
 - Increase N participants and N trials/scan time
- Balancing task difficulty:
 - 2 groups of ASL learners
 - 32 (up from 24) stimuli
 - Two (down from 3) online trainings



	Group 1	Group 2
animals	goat	dog
	hippo	hen
	ostrich	mouse
	turtle	tiger
fruits	coconut	apple
	lemon	cherry
	peach	melon
	pineapple	strawberry
vehicles	airplane	helicopter
	bulldozer	sailboat
	bus	train
	spaceship	truck

Next Steps

- Decoding known vs. unknown words within language
- Individual “Neural Scores” as a predictor of:
 - Quiz performance (same day)
 - Recall 1 week later

Acknowledgements



ASL-LEX

DBIC

Dartmouth
Brain Imaging
Center

