Combined Experiments

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Paper Figures

Relevant figures from (Hu & Nosofsky, 2022, 2024)

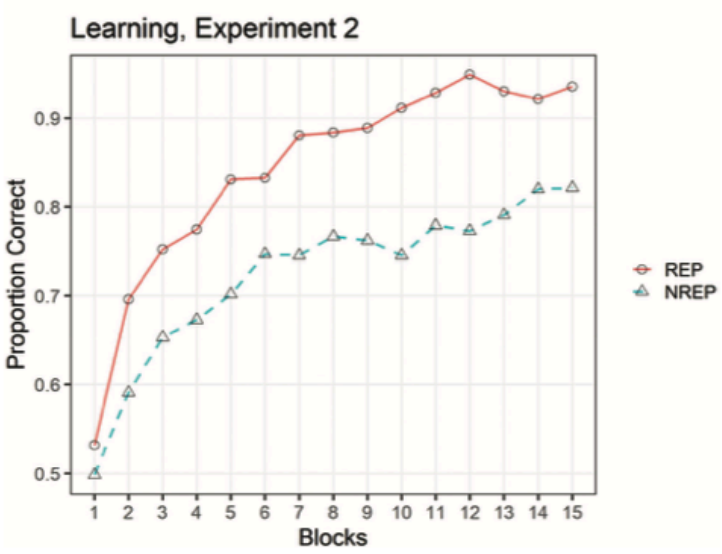
click on image to enlarge

2022 Paper

2024 Paper

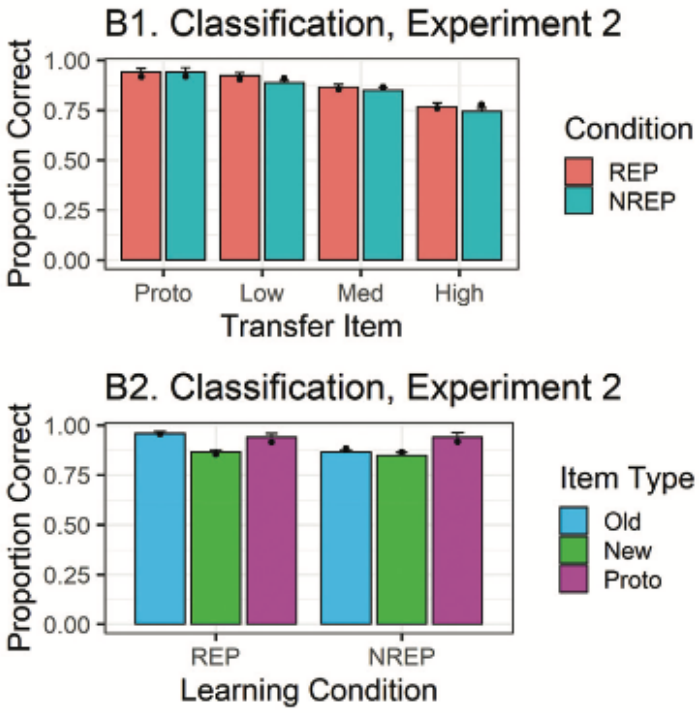
Fixed Prototype Pilot

Comparison of Dot-Pattern Classification Studies



Note. Top panel: Experiment 1, bottom panel: Experiment 2. REP = repeating condition; NREP = nonrepeating condition. See the online article for the color version of this figure.

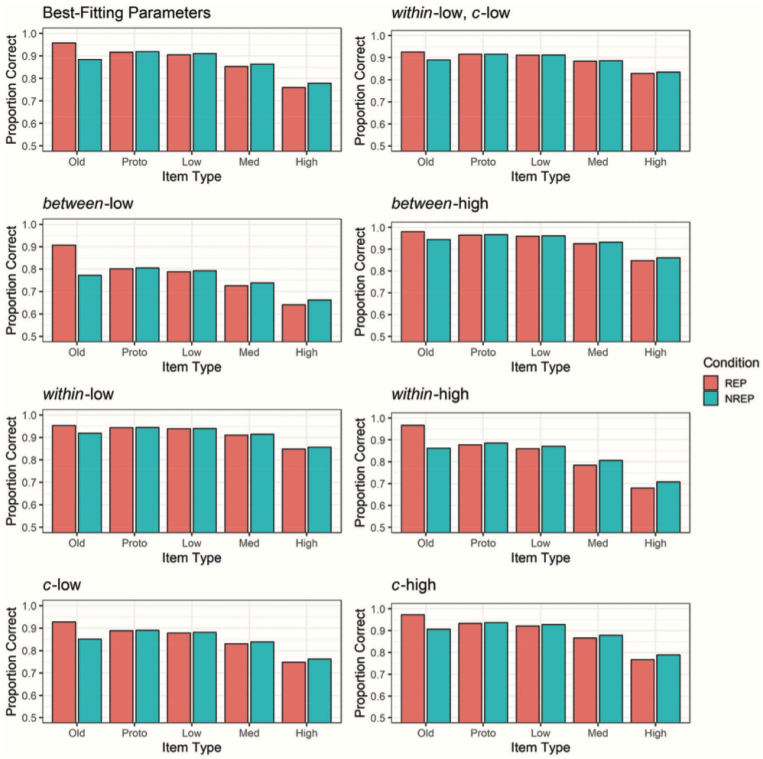
(a) 2022 Learning Curves



(a) 2022 Test Accuracy

Figure 8

Predictions of Classification-Transfer Accuracy From the Exemplar Model Across Different Parameter Variations in the Model (See Main Text for Details)



Note. The settings of the low and high values for each of the model parameters are described in the main text. REP = repeating condition; NREP = nonrepeating condition. See the online article for the color version of this figure.

(a) 2022 Model Predictions

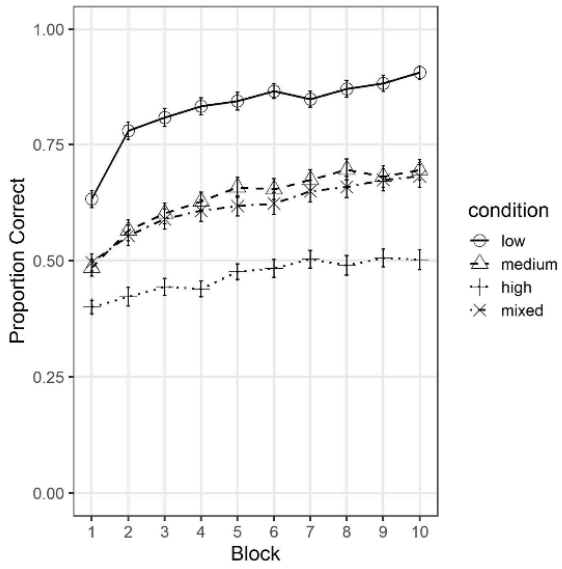


Fig. 2 Mean proportion of correct classifications during the training phase as a function of training condition (low, medium, high, mixed) and training block. Error bars are one standard error of the mean

(a) 2024 Learning Curves

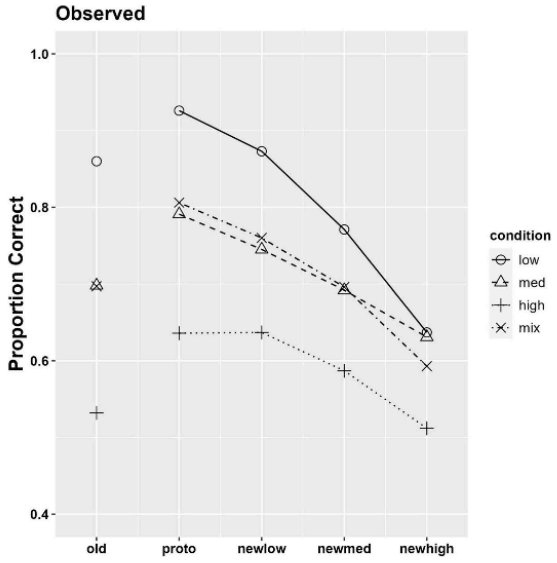


Fig. 3 Mean proportion of correct classifications during the test phase as a function of pattern type and training condition. newlow = new low distortions, newmed = new medium distortions, newhigh = new high distortions

(a) 2024 Test Accuracy

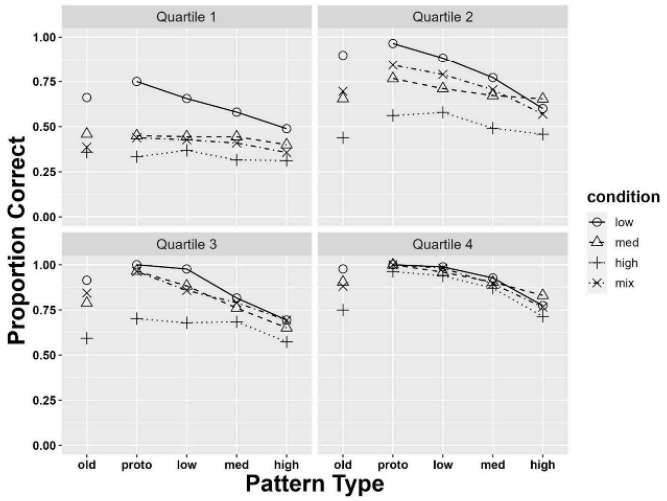
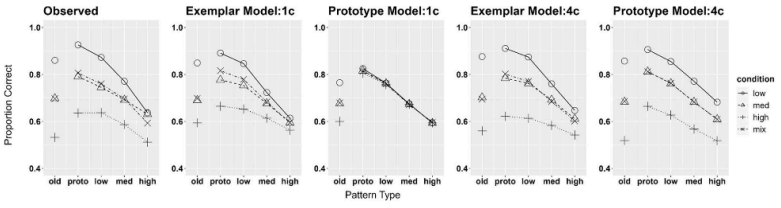
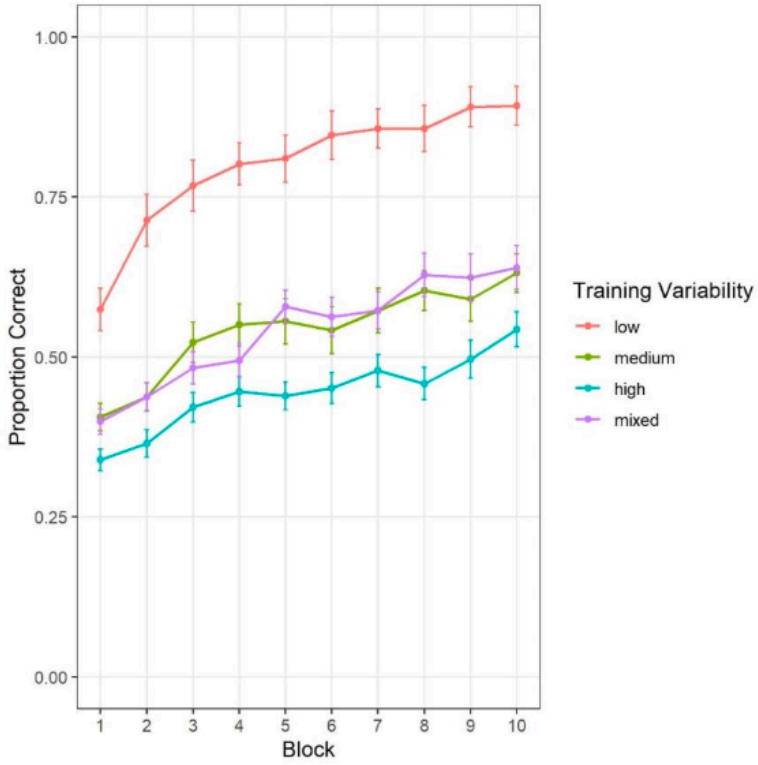


Fig. 4 Mean proportion of correct classifications during the test phase as a function of pattern type and training condition, broken down by overall subject-performance quartiles

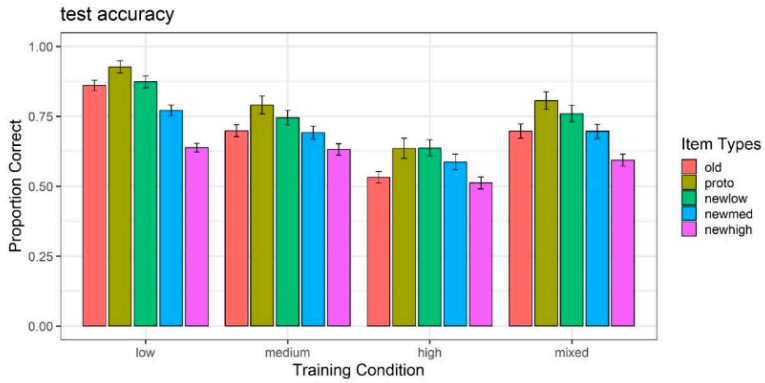
(a) 2024 Test Accuracy - Quartile



(a) 2024 Model Predictions



(a) Pilot Learning Curves



(a) Pilot Test Accuracy

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[1] 8
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Training & Testing shown together

- These plots show mean performance at the start, middle and end of training (first 3 points), and the testing performance for each item type (final 5 points).
- The pilot study included "special" patterns, that were predicted to be more difficult.

click on plots to enlarge

Study	**Hu & Nosofsky (2022)**	**Hu & Nosofsky (2024)**	**Fixed Prototype Pilot Study**
Publication	*JEP: Learning, Memory, and Cognition*	*Memory & Cognition*	*(unpublished pilot study)*
Participants	- 89 Indiana University undergraduates- Course credit participation- Random assignment to conditions (REP or NREP)- Normal or corrected vision	- 304 Indiana University students- Random assignment to conditions (low, medium, high, or mixed distortion)	146 IU Students
Training Stage	**Training Stage**	**Training Stage**	**Training Stage**
• **Procedure**	- **REP Condition:** 15 unique patterns (5 per category), repeated across 15 blocks (**225 trials total**)- **NREP Condition:** 75 unique patterns (5 per category per block), no repetitions (**225 trials total**)	- 10 blocks, 27 trials each (**270 trials total**)- Different set of training patterns in each block- Corrective feedback for 2 seconds after each response	- Training patterns repeated across 10 blocks with randomized presentation order within each block- Four between-subject conditions: low, medium, high, and mixed distortion levels
• **Stimuli**	- 15 or 75 unique dot patterns (depending on condition)- Created using Posner (1967) procedure	- 270 unique training patterns	- 27 unique dot patterns (9 per category)
Testing Stage	**Transfer Phase**	**Testing Stage**	**Testing Stage**
• **Procedure**	- 63 trials total- Random order of presentation	- 84 trials total- Random order of presentation	- 87 trials total- Random order of presentation
• **Stimuli**	- 15 old distortions (5 per category)- 3 prototypes (one per category)- 15 low-level distortions (5 per category)- 15 new medium-level distortions (5 per category)- 15 high-level distortions (5 per category)	- 27 old patterns from the training phase (9 per category)- 3 prototypes (one per category)- 9 new low-level distortions (3 per category)- 18 new medium-level distortions (6 per category)- 27 new high-level distortions (9 per category)	- 27 old distortions (9 per category)- 3 prototypes (1 per category)- 9 new low-level distortions (3 per category)- 18

Notes:

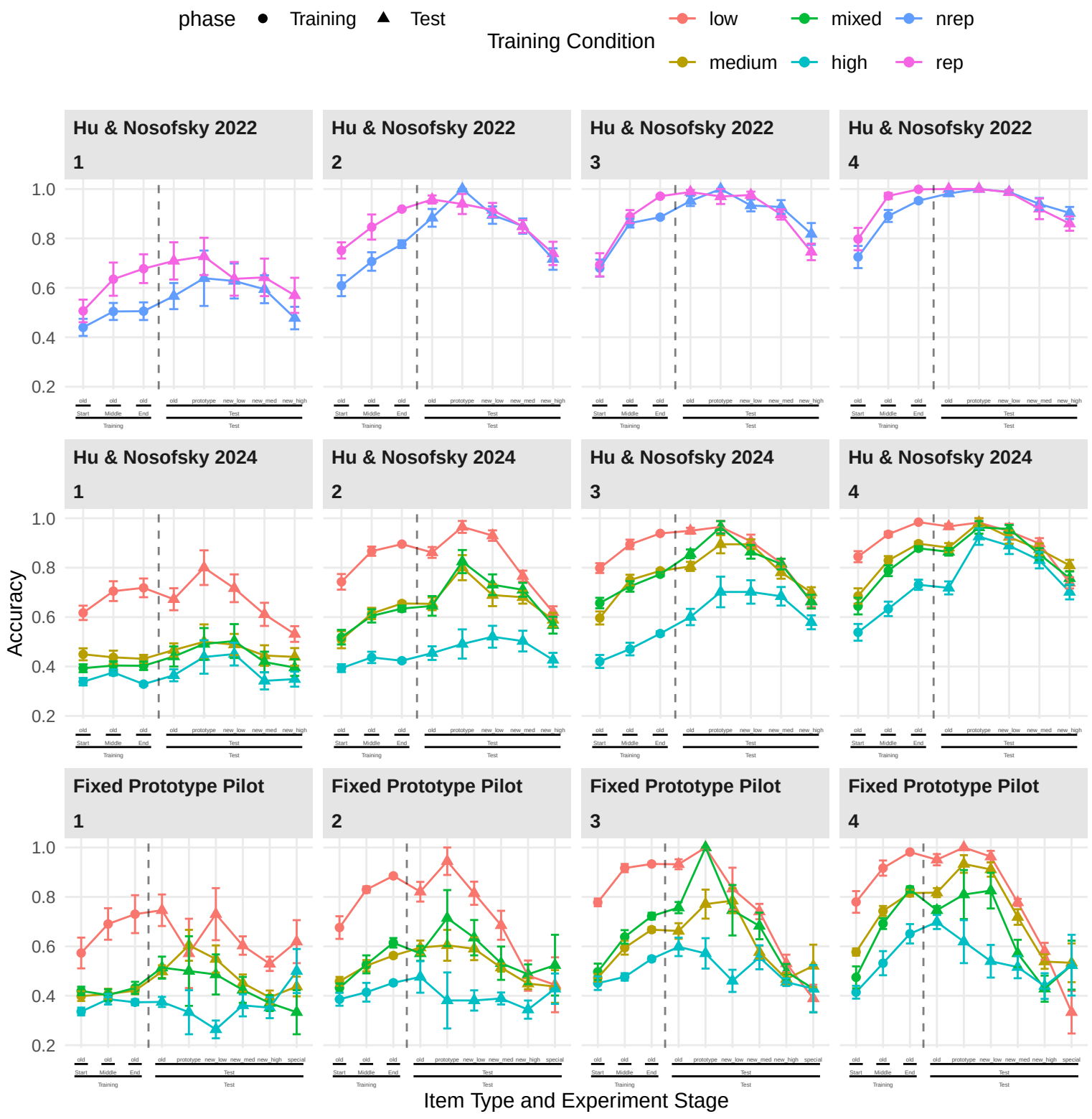
- **REP:** Repeating Protocol
- **NREP:** Nonrepeating Protocol
- **Hu & Nosofsky (2022)** investigated the effects of repeating vs. nonrepeating training patterns on category learning
  ization.
- **Hu & Nosofsky (2024)** examined the impact of different training distortion levels on category learning and generali
  subject has unique prototype set.
- **Fixed Prototype Pilot Study** examined the impact of different training distortion levels on category learning and ge
  Fixed set of prototypes across all subjects.
- All studies used a dot pattern categorization paradigm where participants learned to classify patterns into categories ba
  similarity.
- Dot pattern distortions were created using a modified Posner-Keele (1968) procedure. Low, medium and high distortio
  the dots by an average of 4, 6, and 7.7 Posner-levels respectively.

Training & Testing Performance

Training binned into 3 stages, and Testing Performance for each Item Type

Training & Testing Performance − Quartiles

Training binned into 3 stages, and Testing Performance for each Item Type
Split into 4 quartiles based on end of training performance (1=worst; 4=best)

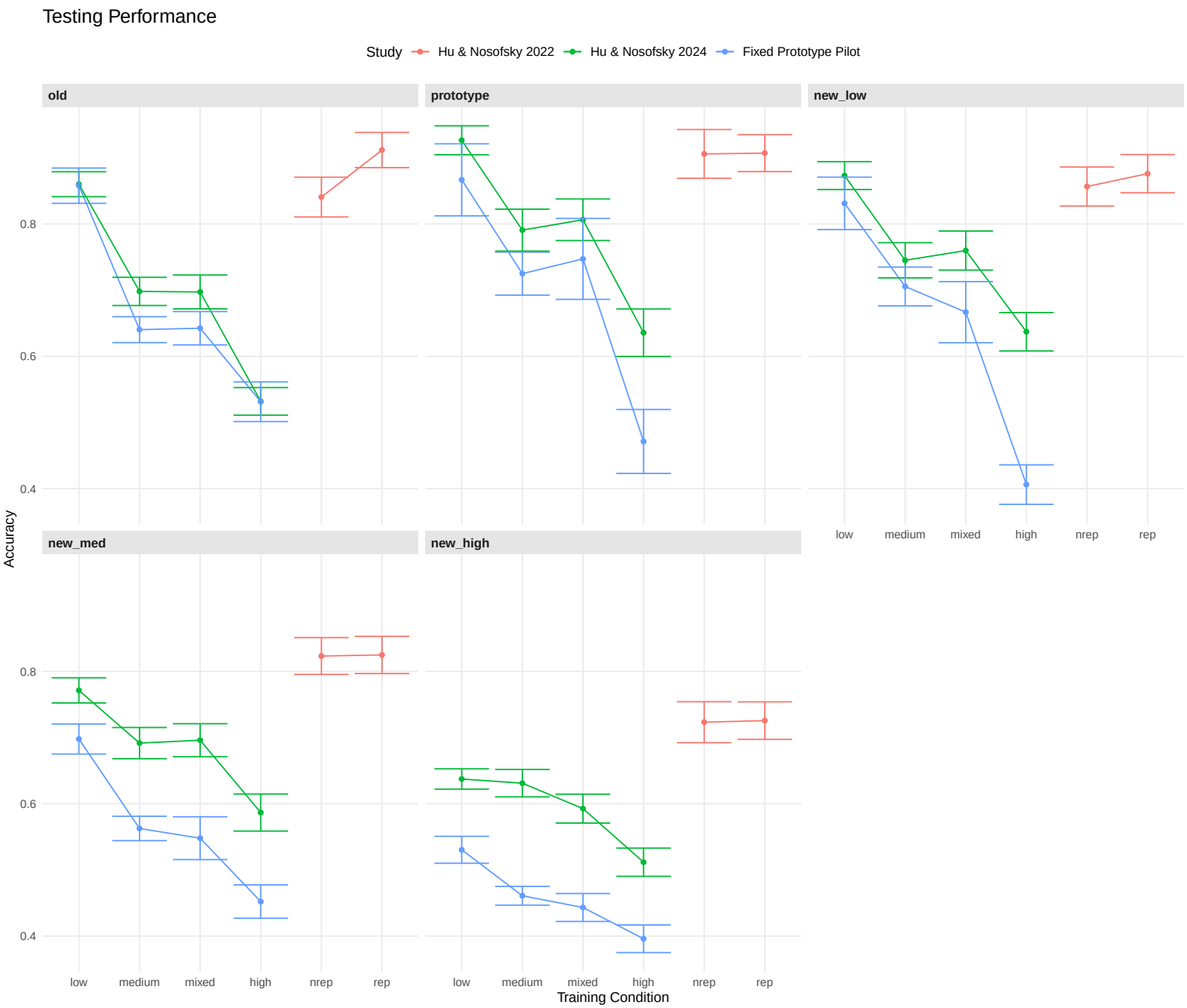


Test Stage Comparisons

Facet by experiment

Testing Performance

Facet by item type

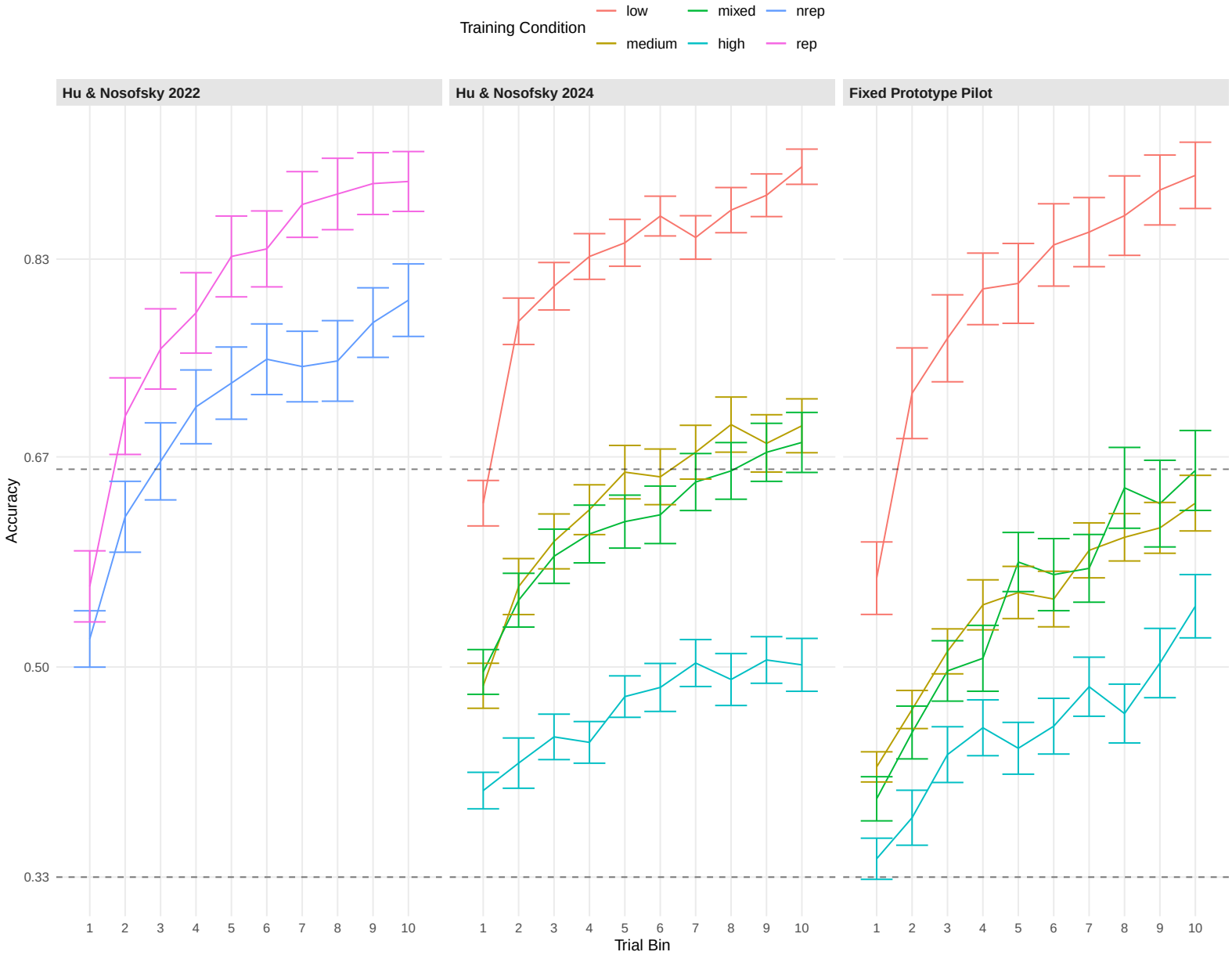


Facet by train group

Training Stage Comparisons

Facet by Exp

Training − All Sbjs.
Training accuracy − 10 bins



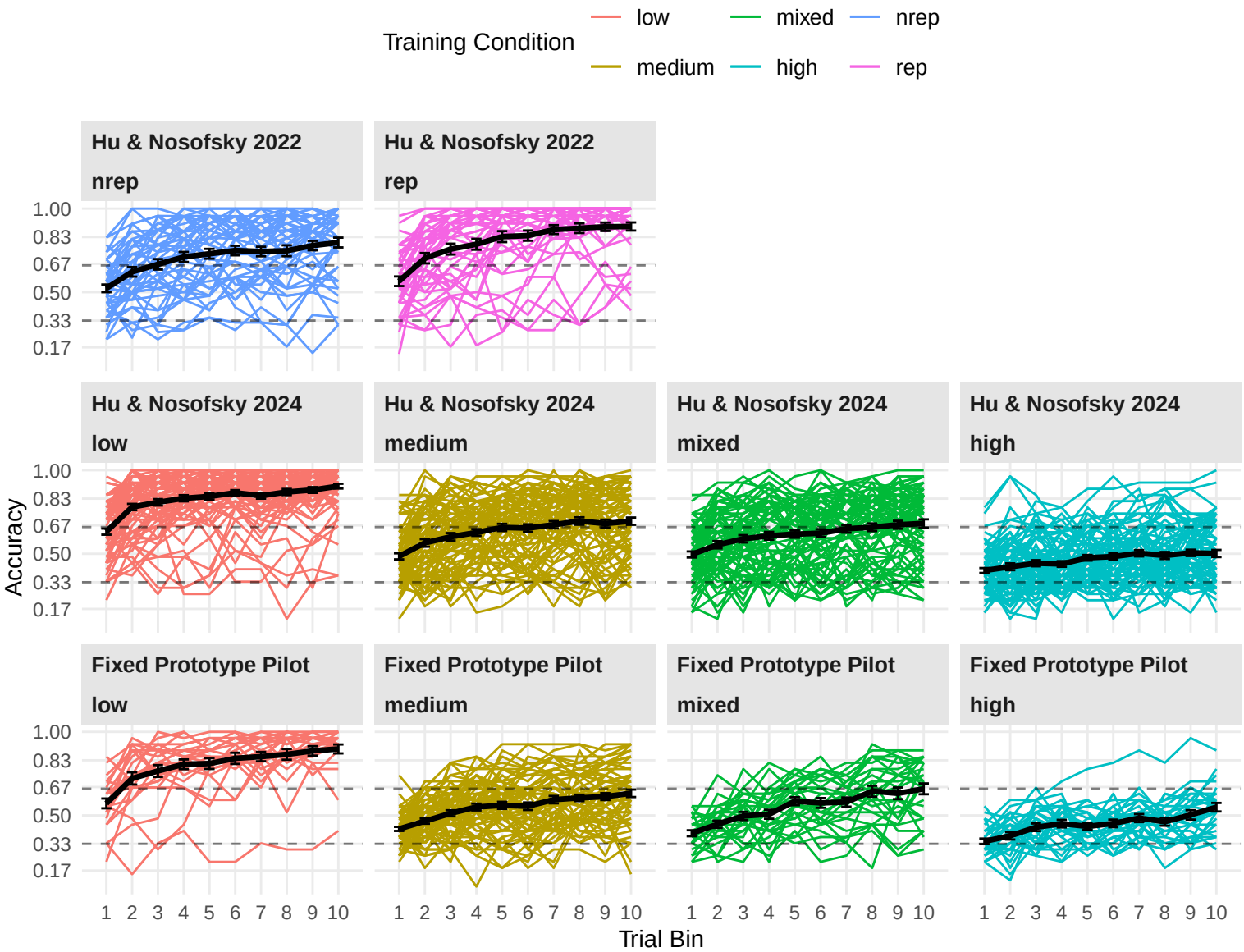
click on plots to enlarge

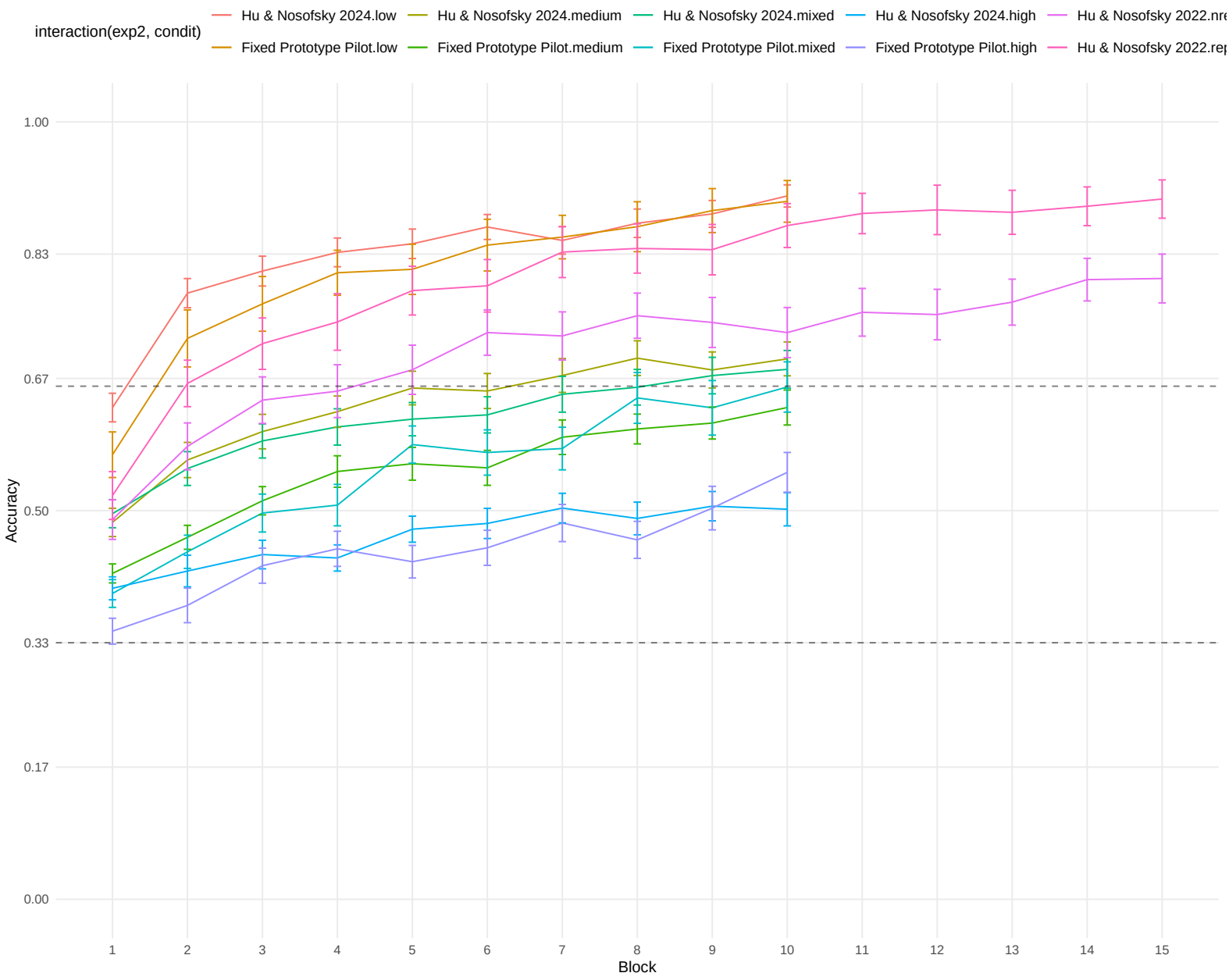
Original Blocks

- Hu & Nosofsky 2022 had 15 blocks of 15 trials each - 225 trials total
- Hu & Nosofsky 2024 & Fixed Prototype pilot each had 10 blocks of 27 trials each - 270 trials total

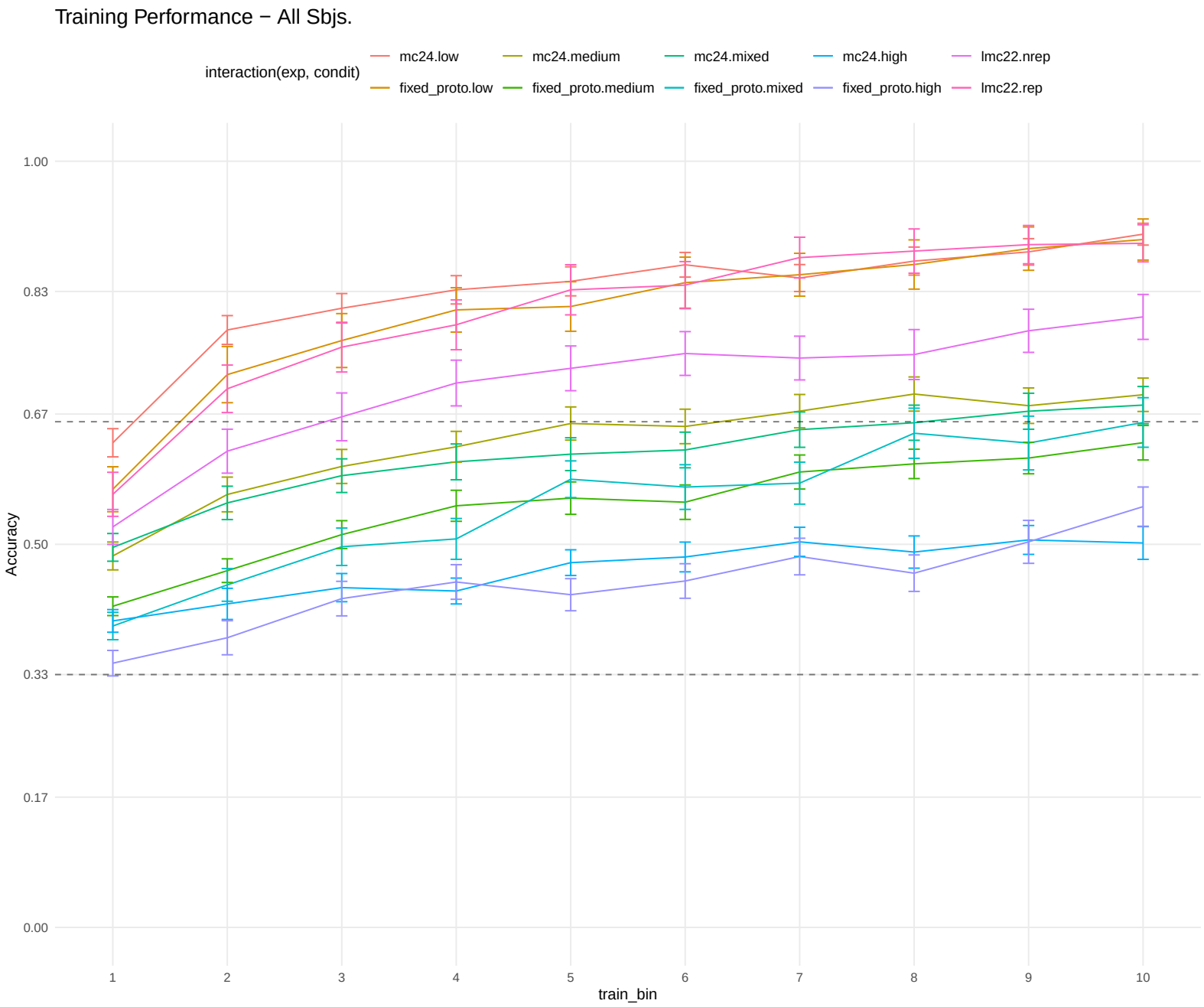
Training − individual learning curves.

Training accuracy − each line is an individual sbj.
Black lines are group averages




Training Performance − All Sbjs.
interaction(exp2, condit)
Hu & Nosofsky 2024.low
Hu & Nosofsky 2024.medium
Hu & Nosofsky 2024.mixed
Hu & Nosofsky 2024.high
Hu & Nosofsky 2022.nre
Fixed Prototype Pilot.low
Fixed Prototype Pilot.medium
Fixed Prototype Pilot.mixed
Fixed Prototype Pilot.high
Hu & Nosofsky 2022.rep
1.00
0.83
0.67
0.50
0.33
0.17
0.00
Accuracy
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Block

Bin into equal sized blocks



Testing Phase Performance Summary

Mean (SE) for Each Item Type and Condition

Condition	Experiment	Phase	Old	Prototype	New Low	New Medium	New High
nrep	Hu & Nosofsky 2022	Test	0.84 (0.03)	**0.91 (0.037)**	0.86 (0.029)	**0.82 (0.028)**	0.72 (0.031)
rep	Hu & Nosofsky 2022	Test	**0.91 (0.027)**	0.91 (0.028)	**0.88 (0.029)**	0.82 (0.028)	**0.73 (0.028)**
low	Hu & Nosofsky 2024	Test	**0.86 (0.019)**	**0.93 (0.022)**	**0.87 (0.021)**	**0.77 (0.019)**	**0.64 (0.015)**
medium	Hu & Nosofsky 2024	Test	0.7 (0.021)	0.79 (0.032)	0.75 (0.027)	0.69 (0.024)	0.63 (0.021)
mixed	Hu & Nosofsky 2024	Test	0.7 (0.026)	0.81 (0.031)	0.76 (0.029)	0.7 (0.025)	0.59 (0.022)
high	Hu & Nosofsky 2024	Test	0.53 (0.021)	0.64 (0.036)	0.64 (0.029)	0.59 (0.028)	0.51 (0.021)
low	Fixed Prototype Pilot	Test	**0.86 (0.027)**	**0.87 (0.054)**	**0.83 (0.04)**	**0.7 (0.023)**	**0.53 (0.02)**
medium	Fixed Prototype Pilot	Test	0.64 (0.02)	0.72 (0.032)	0.71 (0.029)	0.56 (0.018)	0.46 (0.014)
mixed	Fixed Prototype Pilot	Test	0.64 (0.025)	0.75 (0.061)	0.67 (0.046)	0.55 (0.032)	0.44 (0.021)
high	Fixed Prototype Pilot	Test	0.53 (0.03)	0.47 (0.048)	0.41 (0.03)	0.45 (0.025)	0.4 (0.021)

For each experiment, the row with the highest value for each item type is bolded

References

Hu, M., & Nosofsky, R. M. (2022). Exemplar-model account of categorization and recognition when training instances never repeat. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *48*(12), 1947–1969. https://doi.org/10.1037/xlm0001008

Hu, M., & Nosofsky, R. M. (2024). High-variability training does not enhance generalization in the prototype-distortion paradigm. *Memory & Cognition*. https://doi.org/10.3758/s13421-023-01516-1