



Consolidation and Retention in Procedural-Based Categorization

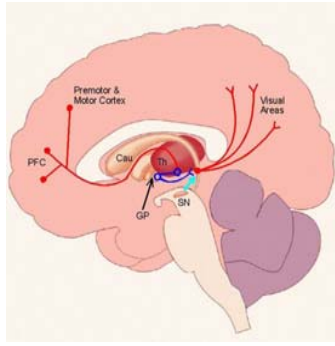


Darrell A. Worthy¹, J. Vincent Filoteo^{2,3} & W. Todd Maddox¹

¹University of Texas; ²Veterans Medical Research Foundation, and ³UCSD

Introduction

- Much evidence supports the existence of neurobiologically distinct category learning systems [e.g., 1 – 4].
- **Procedural-based system:** mediated by the tail of the caudate nucleus and best suited for (nonverbalizable) information-integration category learning.



- Many-to-one mapping from visual areas to the tail of the caudate.
- System associates a response with a region of perceptual space

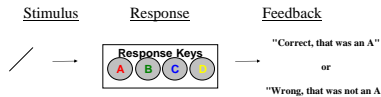
Aims of Study

- To explore consolidation, retention, and generalization in procedural-based categorization.
- To examine the effects of different training methods on consolidation, retention, and generalization.

General Methods

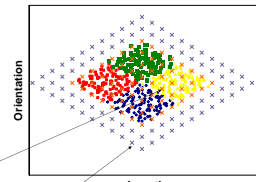
- **Participants:** Healthy young adults.
- **Task:** Perceptual categorization task [5].
 - Single line stimulus. Length and orientation vary across trials.

– Trial Procedure:

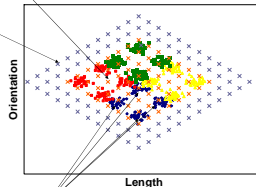


- Two conditions with continuous (N=19) and discontinuous (N=17) categories.

Continuous



Discontinuous



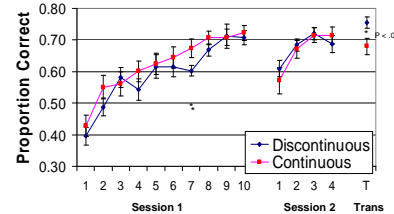
- Multiple striatal units mapped to one category label.

– Session Procedure:

- Session 1:** 10 48-trial training blocks
- Session 2 (one week later):** 4 48-trial retention blocks
- 1 144-trial transfer block

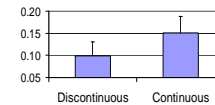
Results

Accuracy



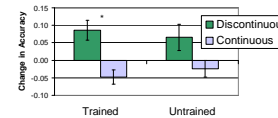
Note: Two continuous and four discontinuous participants were excluded for poor performance (final session 1 < 55%). This equated Session 1 performance.

Retention Cost



- Discontinuous training reduces retention cost.

Change in Accuracy from Final Training to Transfer



- Discontinuous training improves transfer.

Correlations

Session 1, Block 10 – Retention Cost	
Continuous	-.14
Discontinuous	-.64*
Session 1, Block 10- Transfer	
Continuous	.75**
Discontinuous	.31

Summary

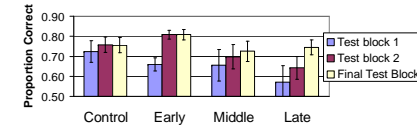
- Discontinuous training improves category retention and generalization.
- Discontinuous but not continuous performance predicts retention cost.
- Discontinuous category training may lead to greater interneuron communication between units in the striatum leading to better generalization[6]

Consolidation Experiment

- Train/Test: 8 50-trial blocks with continuous categories
- Interference: 8 50-trial blocks with a category-label switch.

Condition	0	24 hrs	48hrs
Control	Train		Test
Early	Train ->Interference		Test
Middle	Train	Interference	Test
Late	Train		Interference -> Test

Test Session Accuracy



- Intermediate task interference on consolidation is temporally graded
- Interference is smallest early and largest late.
- Contradicts previous work [7] on explicit/declarative tasks that suggests that interference is largest early.

Conclusions

- Discontinuous training improves retention and generalization, even when initial acquisition is equated.
- Involvement of striatal interneurons during discontinuous training may facilitate generalization and retention [6].
- Effects of interference on consolidation of procedural-based categories is temporally graded, but with a different temporal signature than that found in declarative tasks.

References

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[4] Smith, E.E., Patalano, A.L., & Jonides, J. (1998). Alternative strategies of categorization. *Cognition*, 65, 167-196.

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[7] Wixted, J.T.(2004). The psychology of learning and forgetting. *Annual Review of Psychology*, 55, 235-269.

<http://homepage.psy.utexas.edu/homepage/group/MaddoxLAB/>