

Perceptual Dual-Task Training via Simulation for Veterinary Students

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Introduction: Background

- **Veterinary students**
 - Real world training is impractical
- **Perceptual task**
 - Training improves **general** motor skills for surgeons (Bhokari et al., 2010)
 - **Task-specific** training critical for perceptual tasks (Beck et al., 2012)
- **Cognitive demand**
 - Use **resources** to deal with **tasks** and **stress** (Mathews & Campbell, 2009)

Introduction: Training Methods

Training Method	Pros	Cons
Part-task training (Wightman & Lintern, 1985)	Experience tasks alone, no juggling tasks while learning. Good for difficult tasks	No experience with combining tasks
Dual-task, pure	Learn under same circumstances as tested performance	Limited attention to either task, no opportunity to engage with just one task
Dual-task emphasis change (Gopher, Weil, & Siegel, 1989)	Explore strategies for each individual task when emphasized and strategies for combining tasks (good for tasks completed under cognitive load)	Monitoring own attentional and effort distribution can become a 'dual-task within a dual-task'

Introduction: Purpose

- How best do you train a perceptual task that will be performed under cognitive load?
 - Practice each part of the task alone?
 - Practice all parts together?
 - Something in between?
 - Does learning depend on individual differences (such as working memory capacity)?

Training Method: Part-task training

Train task 1 for ½ time

...then...

Train task 2 for ½ time



distractor

perceptual task

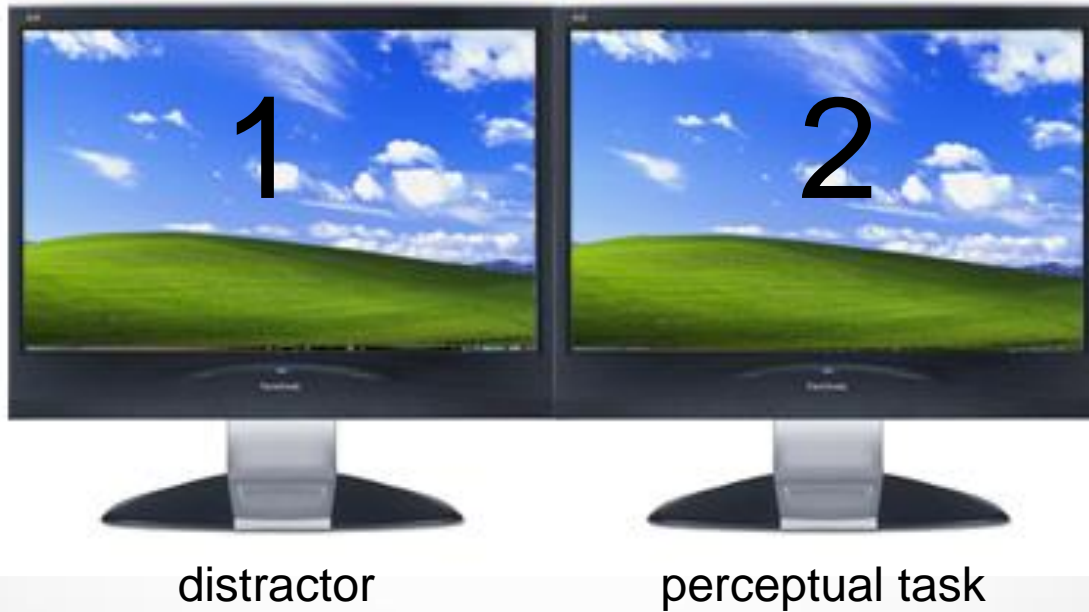


distractor

perceptual task

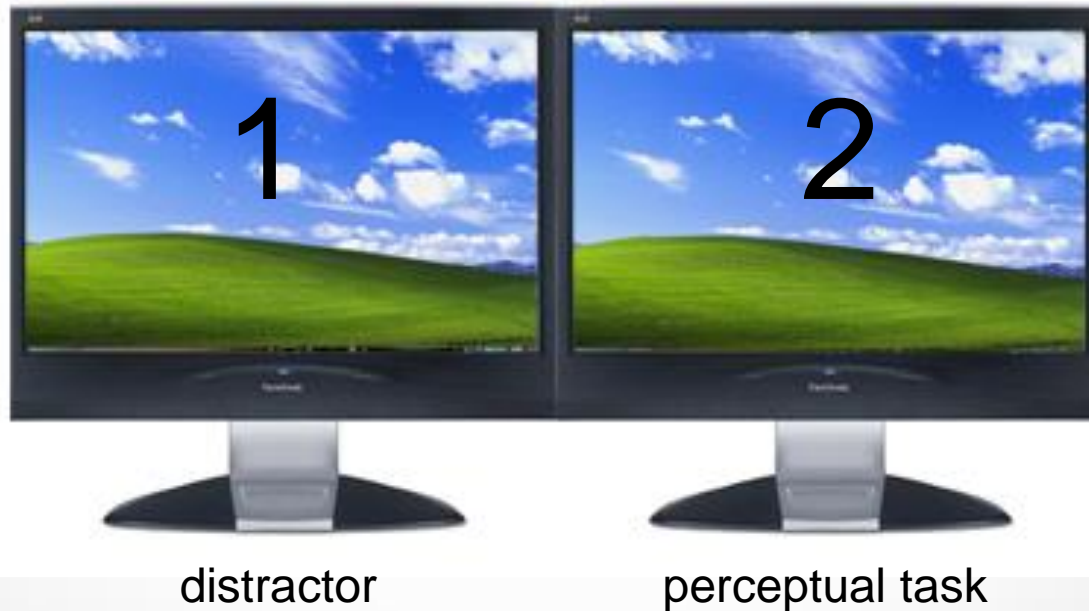
Training Method: Dual-task, Pure

Train both tasks together for whole time



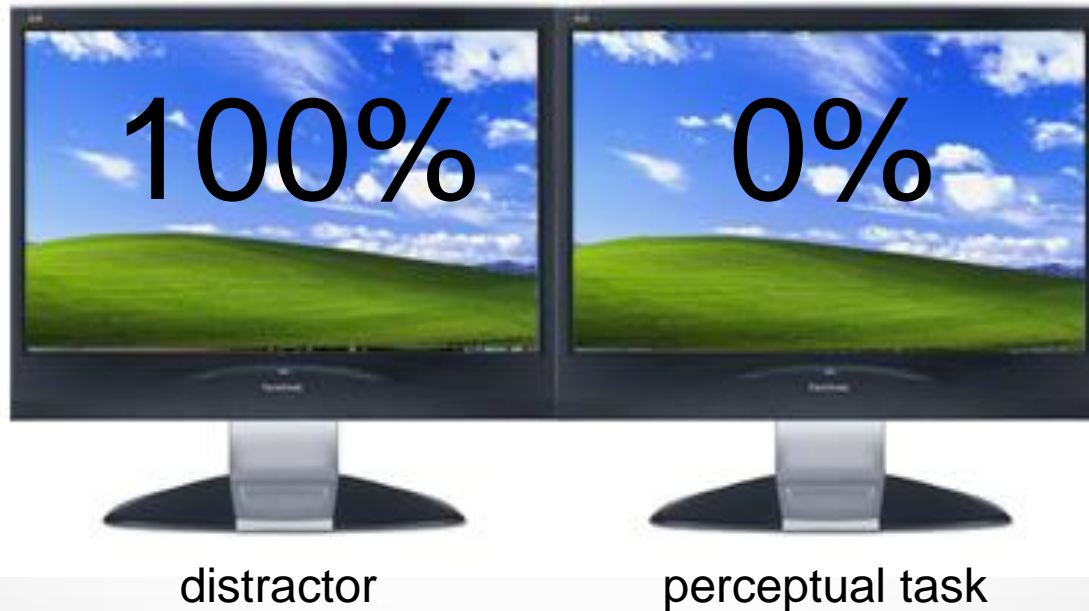
Training Method: Dual-task, Emphasis Change

Train both tasks together for whole time, changing emphasis placed on each task



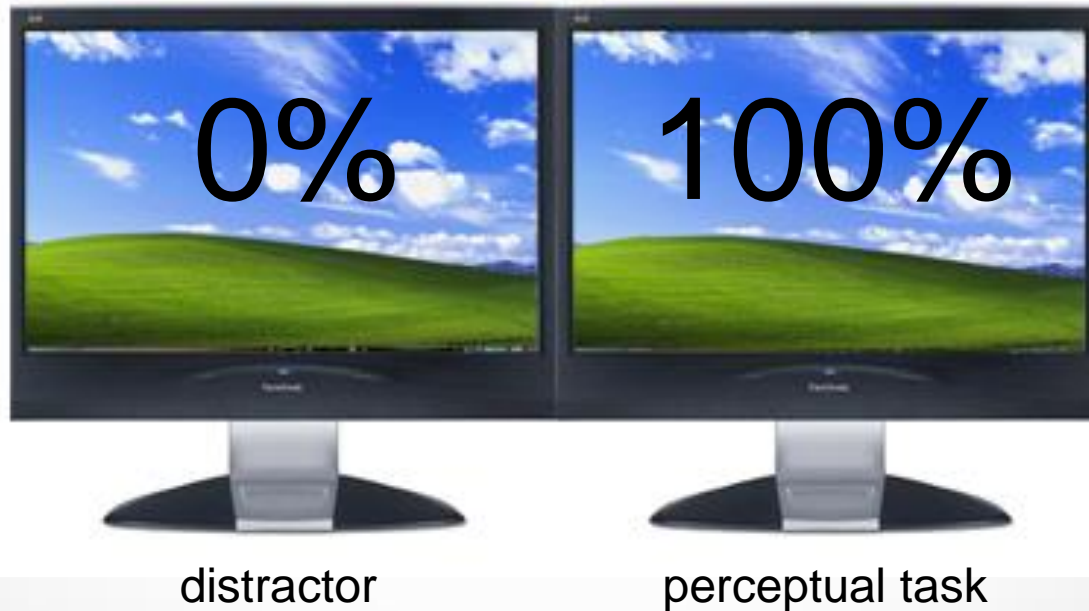
Training Method: Dual-task, Emphasis Change

Block 1



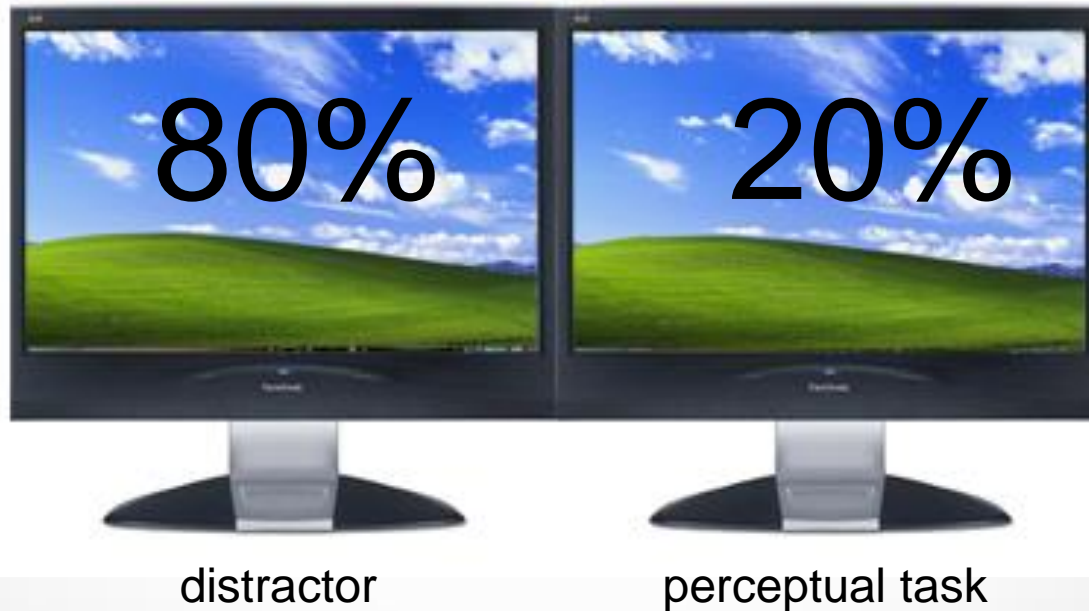
Training Method: Dual-task, Emphasis Change

Block 2



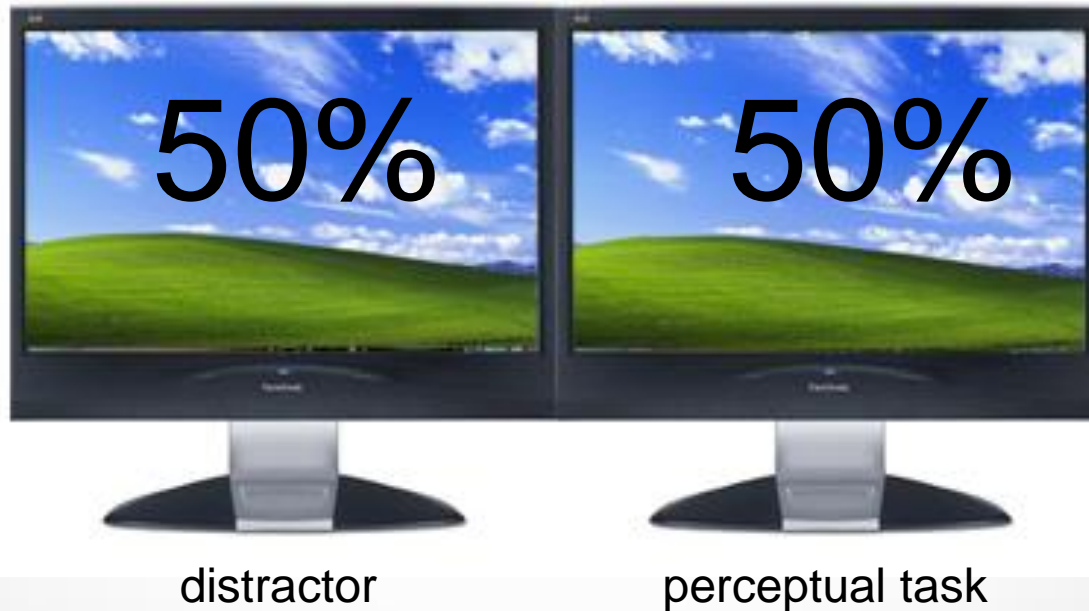
Training Method: Dual-task, Emphasis Change

Block 3



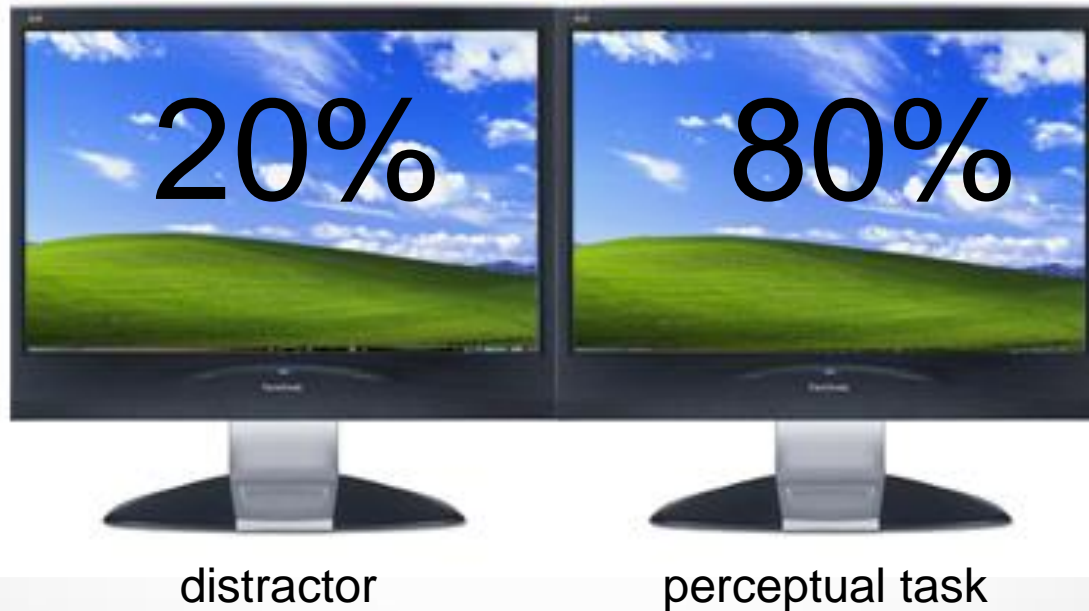
Training Method: Dual-task, Emphasis Change

Block 4



Training Method: Dual-task, Emphasis Change

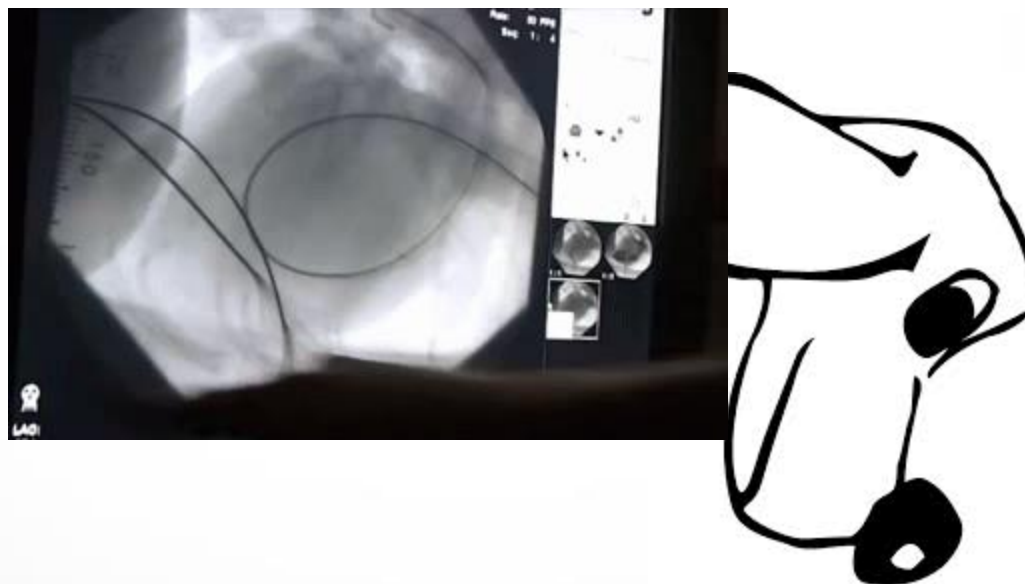
Block 5



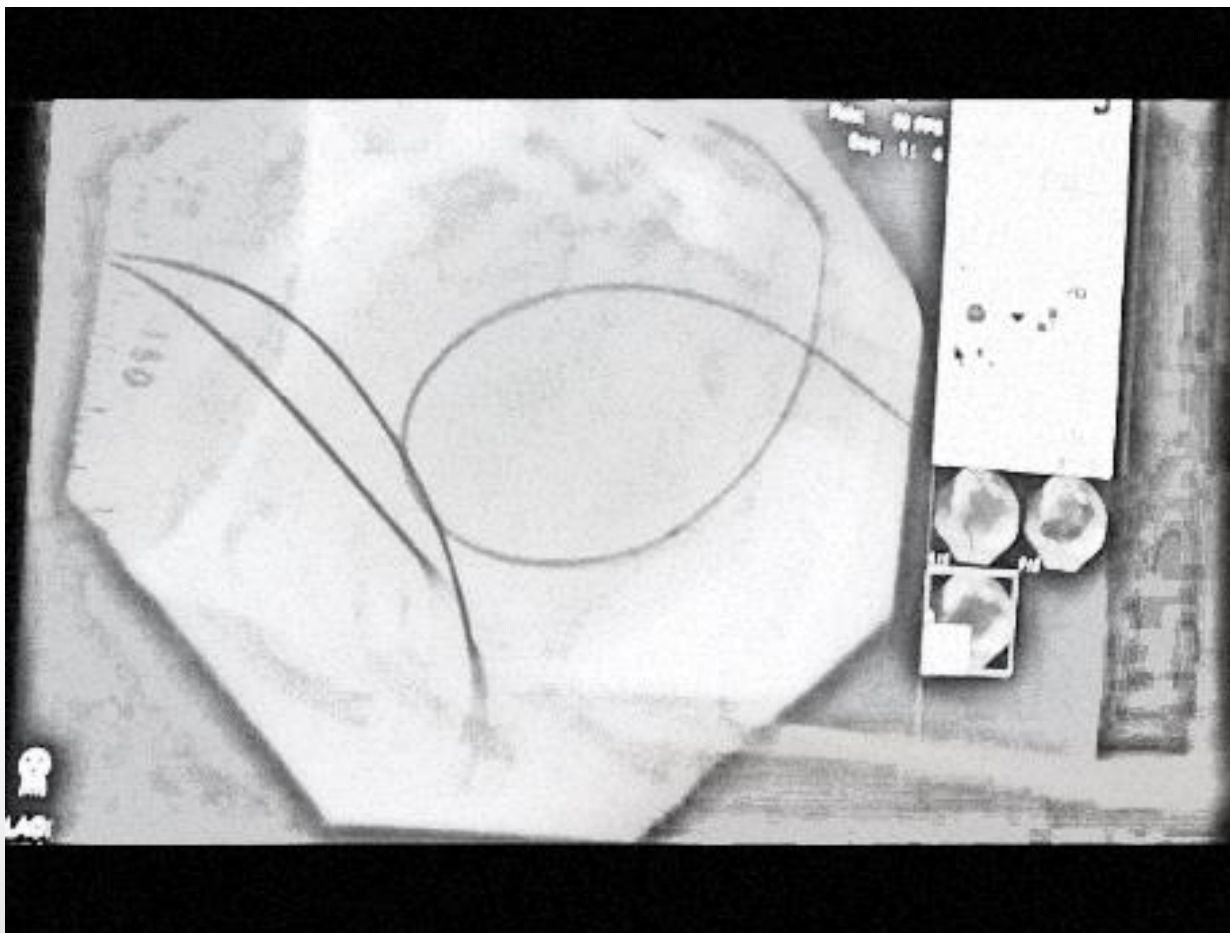
Hypothesis

- Expected participants in emphasis change group to outperform other groups
 - Emphasis change training can improve performance under cognitive load (Gopher, Weil, Siegel, 1989)

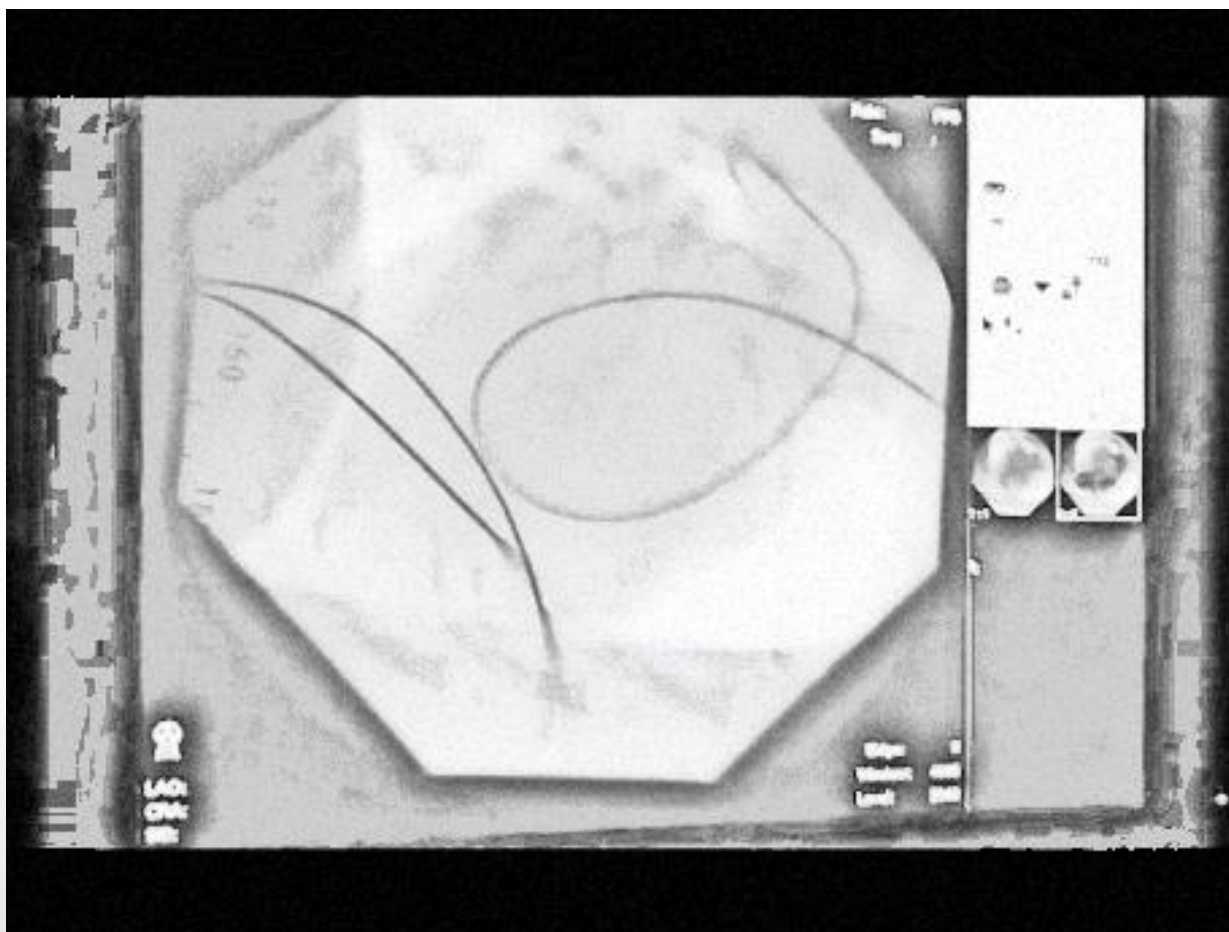
Method: Stimuli – lead wires



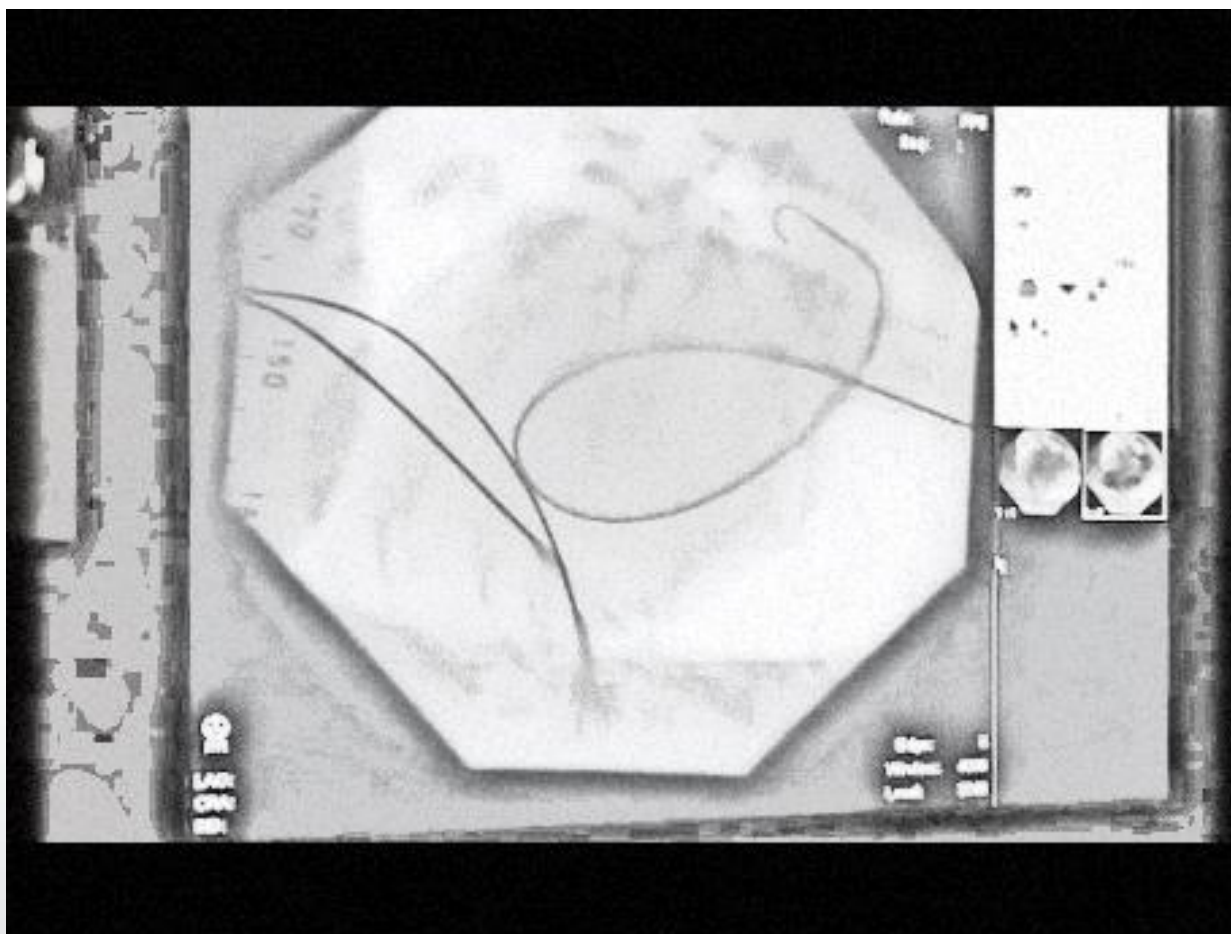
Method: Stimuli – Good lead wire



Method: Stimuli – Fair lead wire



Method: Stimuli – Poor lead wire



Method: Stimuli – 1-back task



Participants, N=21

Condition	DTEC (N = 7)			DTP (N = 7)			PTT (N = 7)		
	M	SD	N	M	SD	N	M	SD	N
Age	20.86	2.48		22.29	2.87		20.43	1.90	
Females / Males			3 / 4			5 / 2			2 / 5
High WMC (z-sc.)	1.20	1.26	4	.63	.81	3	1.67	.67	4
Low WMC (z-sc.)	-1.15	1.23	3	-1.42	.92	4	-1.41	.30	3
Operation Span	46.00	18.02		37.14	19.40		34.50	18.216	
Symmetry Span	21.86	9.82		19.86	5.40		20.86	7.29	

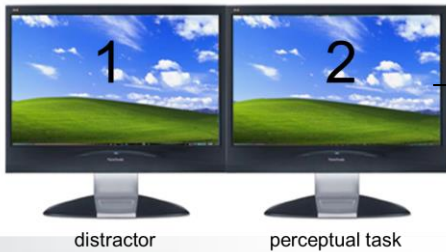
Procedure

1. Assigned to 1 of 3 training conditions
2. Demographics, and WMC tests
3. Retention and Transfer tests

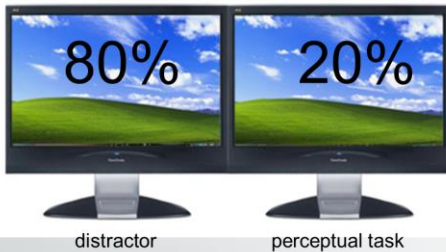
Part-task training



Dual-task, Pure

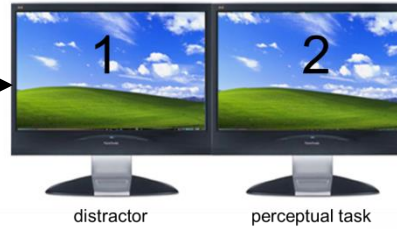


Dual-task, Emphasis Change

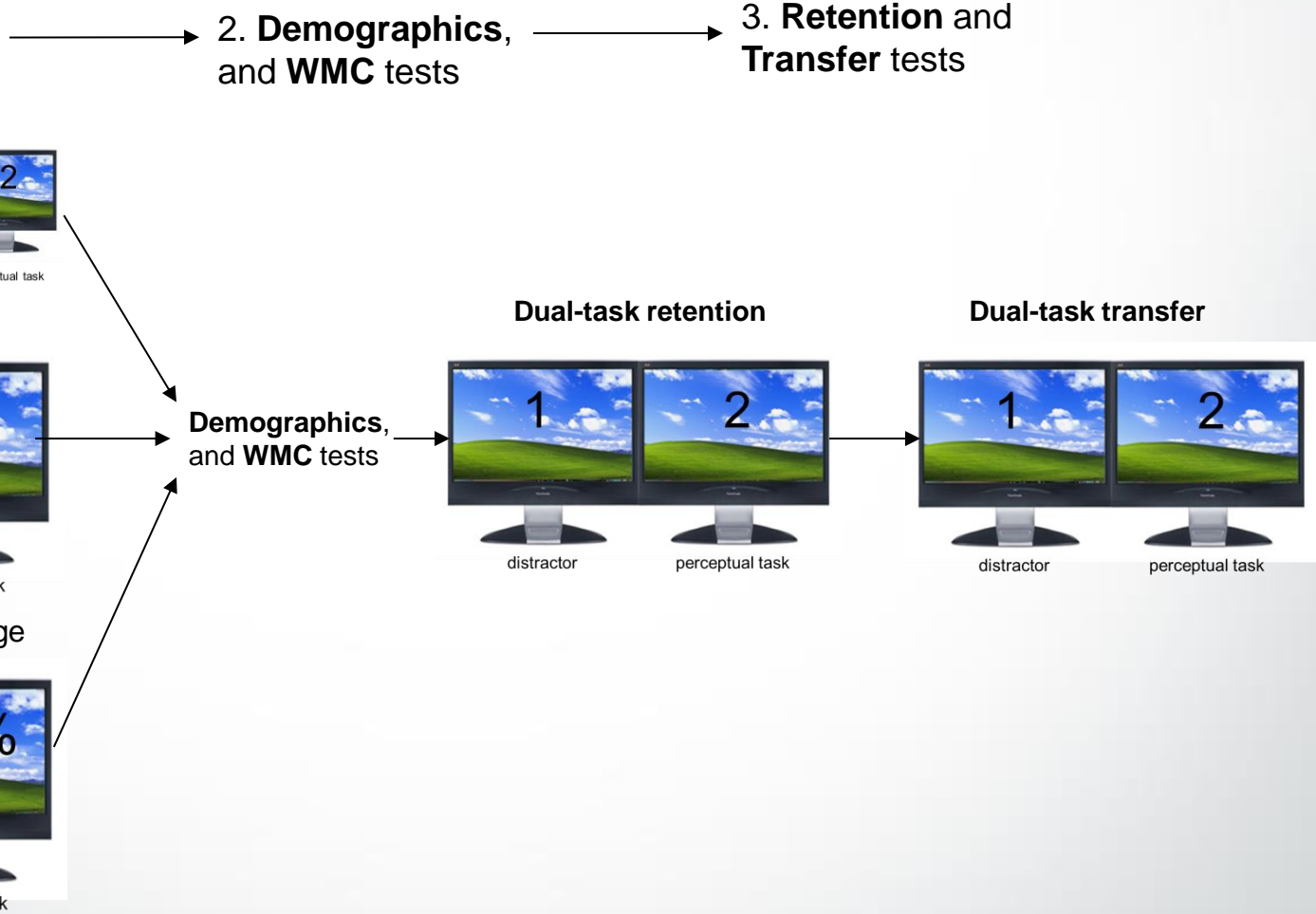
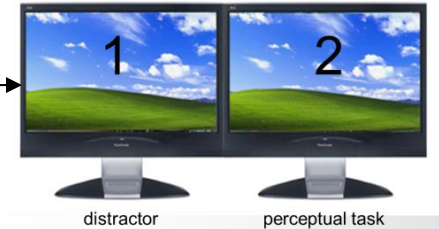


Demographics, and WMC tests

Dual-task retention



Dual-task transfer



Procedure

1. Assigned to 1 of 3 training conditions

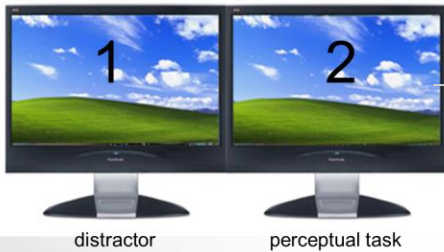
2. Demographics, and WMC tests

3. Retention and Transfer tests

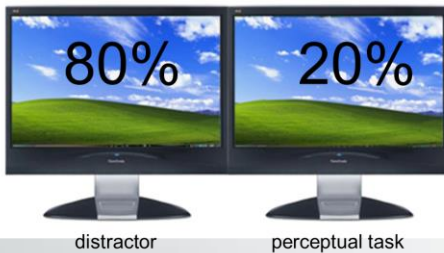
Part-task training



Dual-task, Pure



Dual-task, Emphasis Change



Demographics, and WMC tests

Dual-task retention



Dual-task transfer



Procedure

1. Assigned to 1 of 3 training conditions

2. **Demographics, and WMC tests**

3. **Retention and Transfer tests**

Part-task training



Dual-task, Pure



Dual-task, Emphasis Change



Demographics, and WMC tests

Dual-task retention



Dual-task transfer



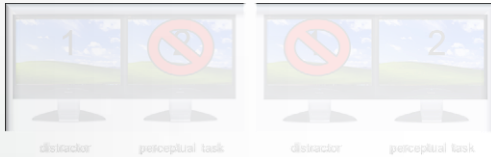
Procedure

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Part-task training



Dual-task, Pure

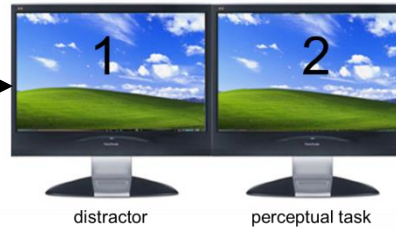


Dual-task, Emphasis Change

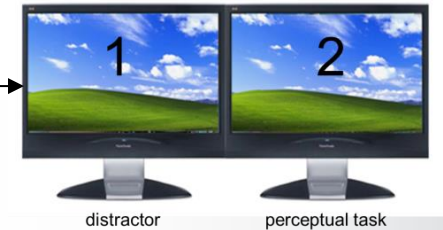


Demographics, and WMC tests

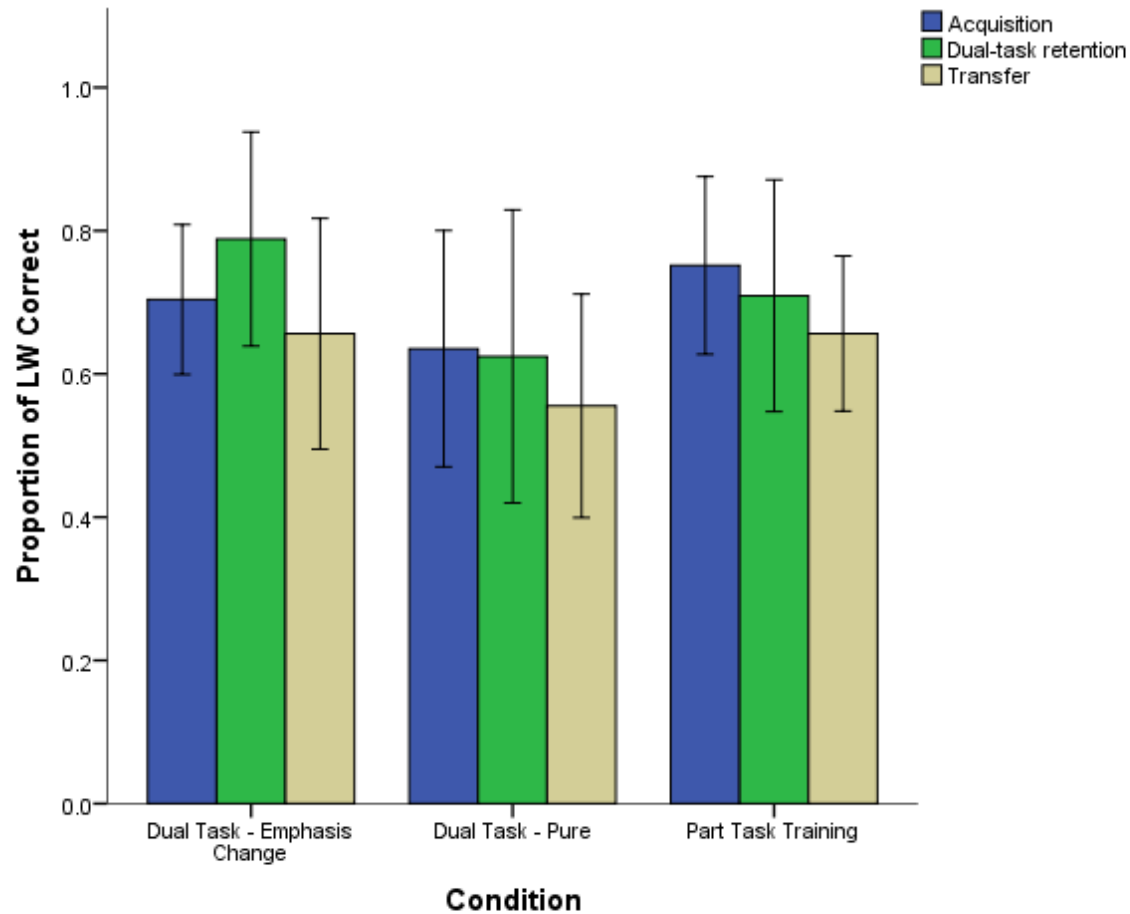
Dual-task retention



Dual-task transfer

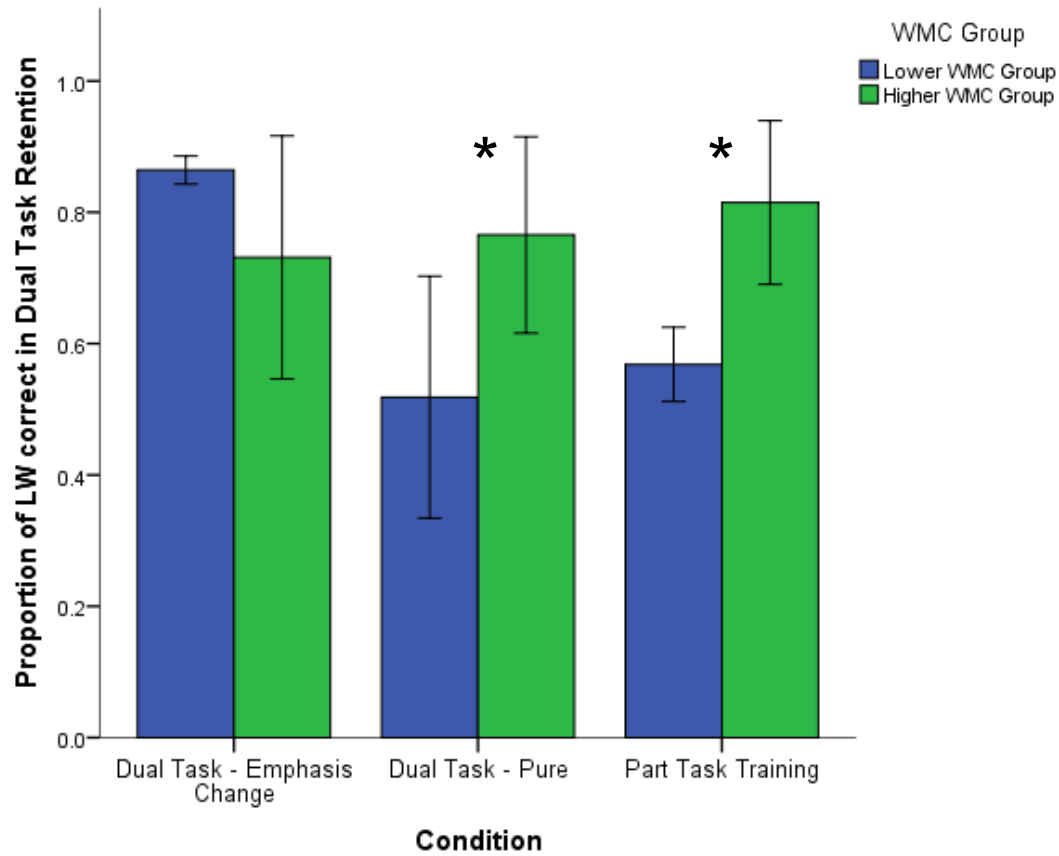


Results: Training Groups



Error Bars: +/- 1 SD

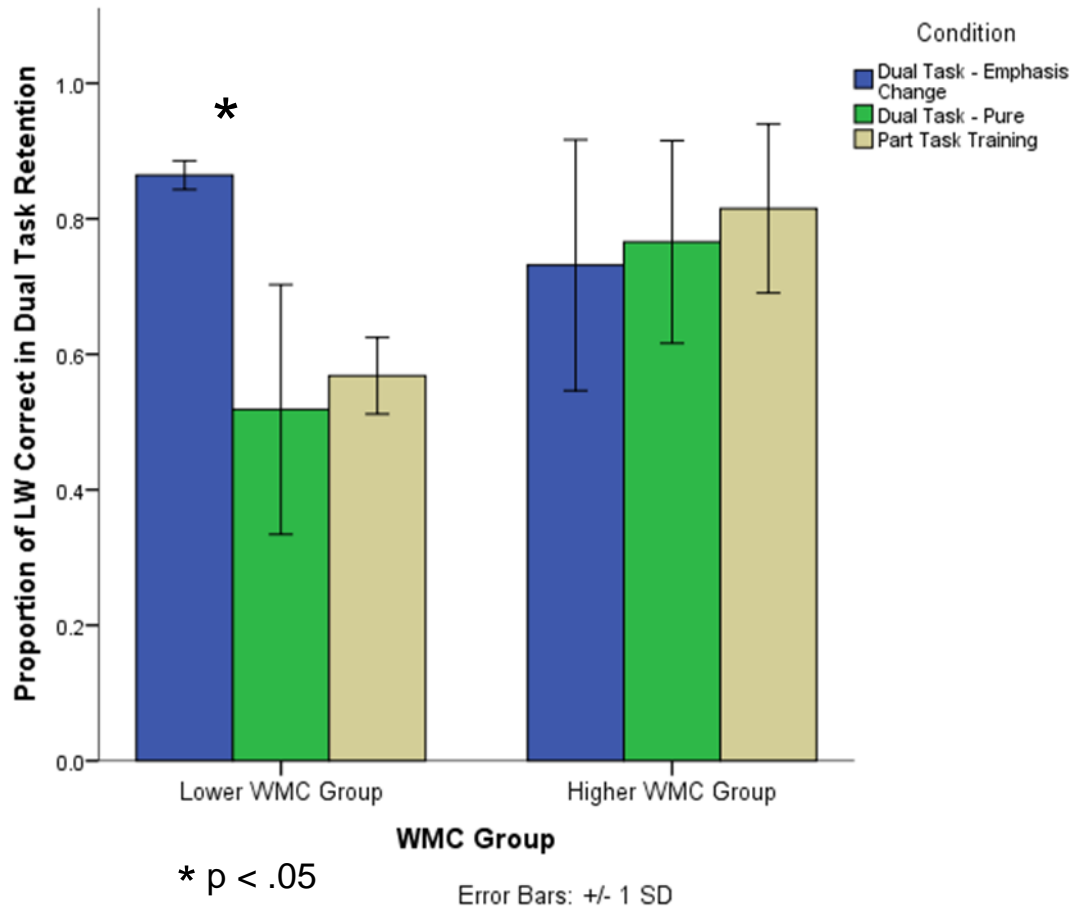
Results: Training Groups



* $p < .05$

Error Bars: ± 1 SD

Results: WMC Groups



Results: Summarized

- Poor scores overall in near transfer task
- In dual-task pure and part-task training conditions, Higher WMC outperform lower WMC
- Within Lower WMC group, dual-task emphasis change outperforms dual-task pure group
 - Doesn't perform differently than higher WMC counterparts

Discussion: Perceptually task-specific

- Poor transfer scores support the use of task-specific, 'eyes-on' training for perceptual tasks

Discussion: WMC Possible explanations

- Low WMC
 - Less proficient at holding relevant information in WM
 - Emphasis change technique allowed practice at honing in on only the relevant information (task exploration), reducing cognitive load

Future Directions

- Mirror training environment more closely to task demands of surgical environment
 - Time N-1 back task at frequency of ‘real-world’ surgical tasks (e.g., checking vitals)
 - Train with video clips rather than still images to give more ‘real world’ task-specific practice with perceptual stimuli
- Take measurements of workload and stress during performance

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