Training & Transfer Effects Using a Complex Span Working Memory Task

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Background & Motivation

- **Can WM capacity be improved through training with a complex WM span task?**
  - Prior work indicates that WM improves with repetitive practice

    CogMed: Klingberg et al., 2002, 2005
    N-back variants: Verhaeghen et al., 2004, Jaeggi et al., 2008
    Updating task: Dahlin et al., 2008

  - Present study uses a more widely investigated WM measure – complex WM span – as the training task
- **Do the benefits of WM training transfer to other cognitive skills?**
  - Prior studies have shown transfer through working memory training (e.g., Gf, Stroop, N-back)
  - Explore transfer in a more extensive battery of cognitive tests
  - Current training targets domain-general WM mechanisms to promote broader transfer

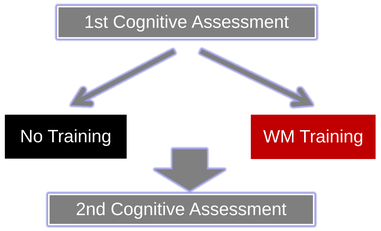
Study Overview

- **Experiment 1- verbal and spatial WM training versus untrained control**
- **Experiment 2- verbal WM Training, verbal STM training, & spatial visualization training**

Cognitive Assessment Battery	Exp 1	Exp 2
Working Memory Capacity (Storage + Processing)	◆	◆*
Short Term Memory Capacity (Storage Only)	◆	◆
Cognitive Control (Stroop)	◆	◆
Reading Comprehension (Nelson Denny)	◆	◆
Mental Rotation (MRT-A)		◆
Nonverbal Fluid Intelligence (Ravens)	◆	
Spatial Reasoning (Paper folding, Surface Dev.)	◆	◆
Verbal Reasoning (Nonsense Sylll., Inference)	◆	◆

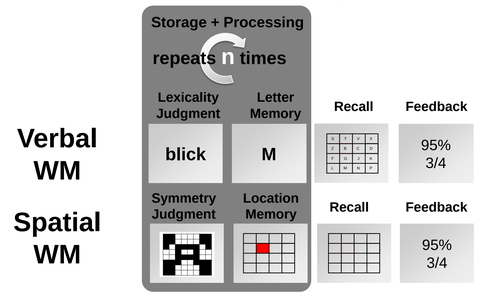
*Experiments 1 & 2 used different measures of WM Capacity

Experiment 1 - Design



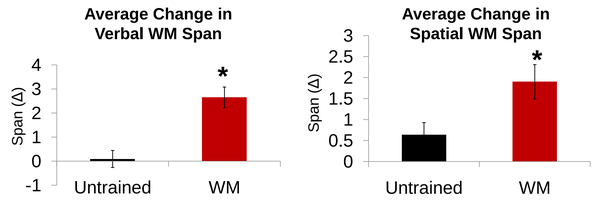
Experiment 1 - Training

- Participants (n=20) trained for 4 weeks, completing a total of 20 daily training sessions (~ 30 min. each)
  - Difficulty (n) adjusted according to performance

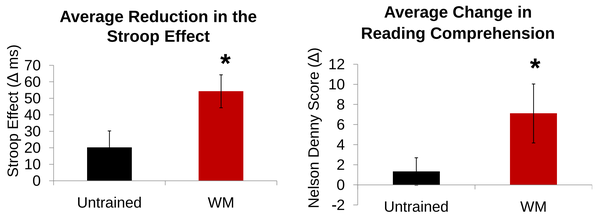


Experiment 1 - Results

Practice Effects



Transfer Effects

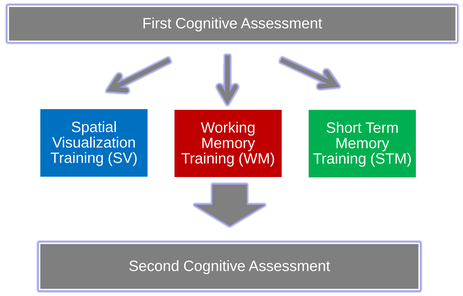


Measures of verbal and spatial reasoning, and Gf did not exhibit significant or selective training effects

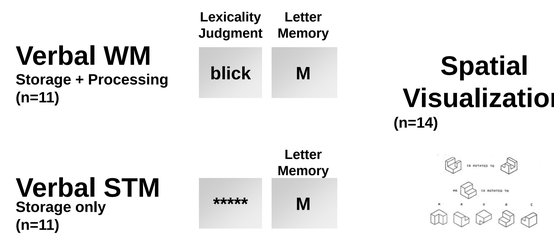
Experiment 2 - Aims

- **Replicate/Extend findings from Experiment 1**
  - Contrast WM and STM training in the verbal domain
  - Include active control group
- **Examine influence of WM training on Spatial Intelligence**
  - Collaboration with the Spatial Intelligence and Learning Center (SILC)
  - Contrast WM training and spatial visualization training (Sorby workbook, 2008)

Experiment 2 - Design

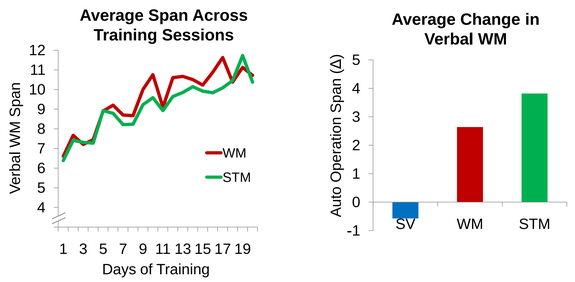


Experiment 2 - Training

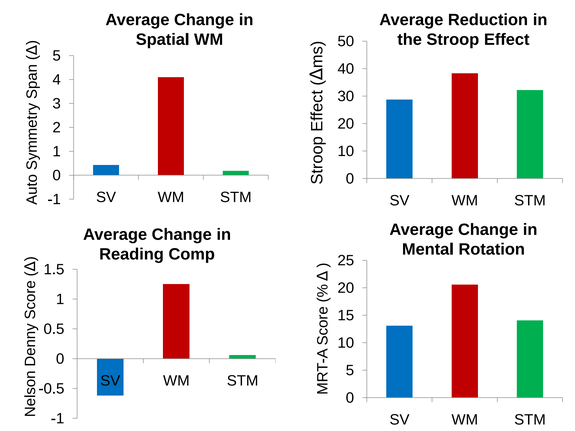


Experiment 2 - Results

Practice Effects

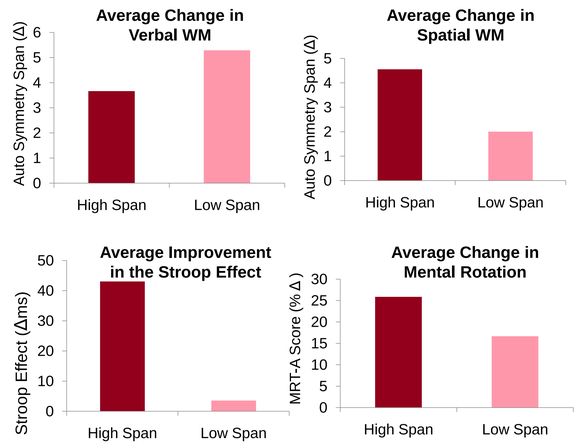


Transfer Effects



Who Benefits?

- WM training produced the highest level of transfer
- Which subjects show the greatest degree of transfer following WM training?
- Identified subjects as "High WM span" and "Low WM span" groups based on a median split of composite WM score from 1st cognitive assessment



Conclusions

- Training in an adaptive complex WM span task results in significant WM capacity increases
- WM training leads to improvements in other cognitive abilities
  - Transfer across domains (verbal to spatial)
  - Transfer to non-WM tasks
  - Implicates a domain-general mechanism
- High span individuals seem to capitalize on transfer benefits of training
  - May indicate differential strategy engagement during training

References

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