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THE UNIVERSITY OF NEW SOUTH WALES

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Learning a non-manipulative task showing hands: Opposite effects in dynamic vs. static pictures

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Outline

1) Transient Information Effect in Animations
2) Human Movement Effect
3) Embodied Cognition
4) Experiment: Non-Manipulative Task
   - Hypotheses
   - Method
   - Results
   - Conclusions
5) Instructional Implications

Transient I

Transient Information Effect in Animations

Three simultaneous cognitive tasks in working memory:

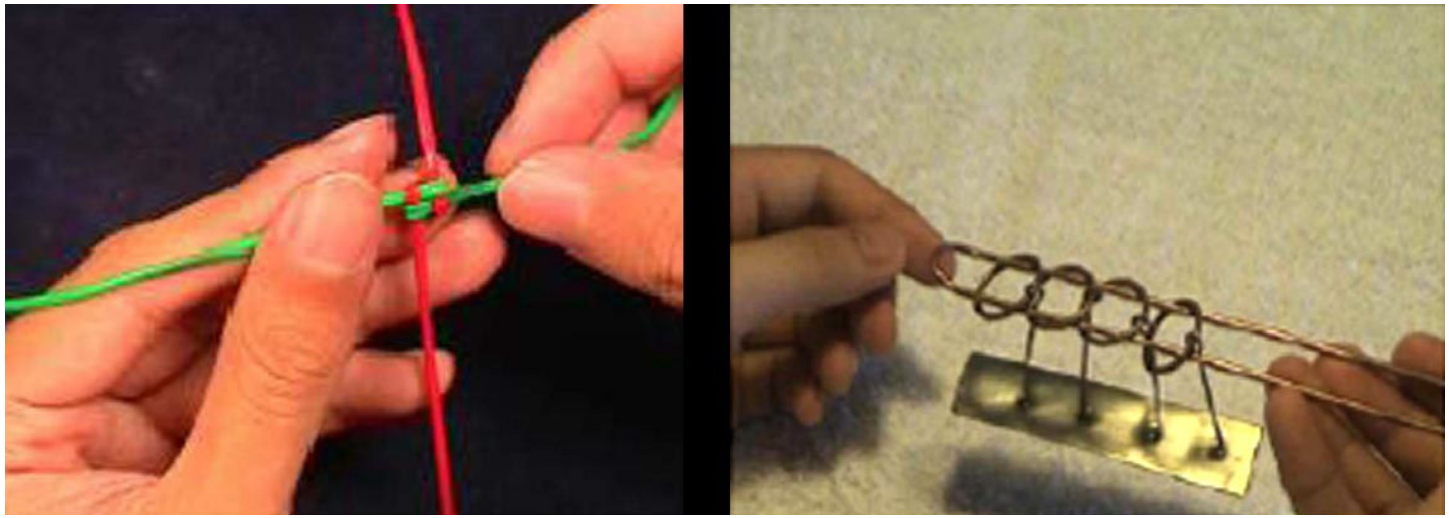
1) Process the current visible information[1]
2) Remember the previous elements that are no longer visible[1]
3) Integrate both streams of information in order to comprehend the material[2]

1) Ayres & Paas, 2007.
2) van Gog, Paas, Marcus, Ayres, & Sweller, 2009.

Human Movement Effect[1]

Animation effective tasks:

Learn by observing human manipulative tasks[2,3,4]



1) Paas & Sweller, 2012
2) Ayres, Marcus, Chan, & Qian, 2009.
3) Marcus, Cleary, Wong, & Ayres, 2013.
4) Wong et al., 2009.

Embodied Cognition

Mirror Neurons

Visuomotor neurons that are activated when individuals do an action or observe others doing a similar action[1], for example, a manipulative action

Hand Effects

- Hand actions produce positive effects on perception, attention, and memory[2]
- Showing hands manipulating or gesturing can assist learning[3]

1) Rizzolatti & Craighero, 2004.
2) Brockmole, Davoli, Abrams, & Witt, 2013.
3) de Koning & Tabbers, 2011.

Experiment: Non-Manipulative Task

Hypotheses

1) The with-hands condition would lead to higher learning* than the no-hands condition
2) The statics presentation would lead to higher learning than the animation presentation

*Higher accuracy, lower mental effort rating, and higher efficiency.

Experiment: Non-Manipulative Task

Methods

The task was to position 9 abstract symbols of different colours and types on a 3 x 3 grid

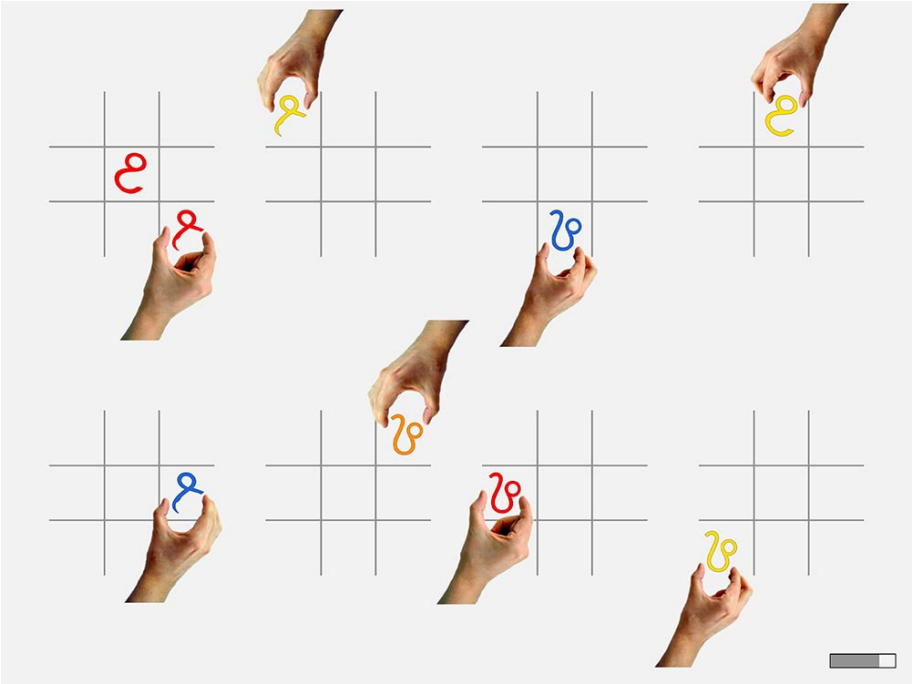
56 participants (18 , 38 , M= 20.7 years) randomly allocated according to a 2 x 2 factorial design:

Hands	Presentation	
	Statics	Animation
Not shown	no-hands/statics	no-hands/animation
Shown	with-hands/statics	with-hands/animation

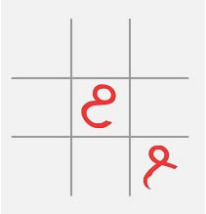
Experiment: Non-Manipulative Task

Methods

with-hands/statics



no-hands/animation



Experiment: Non-Manipulative Task

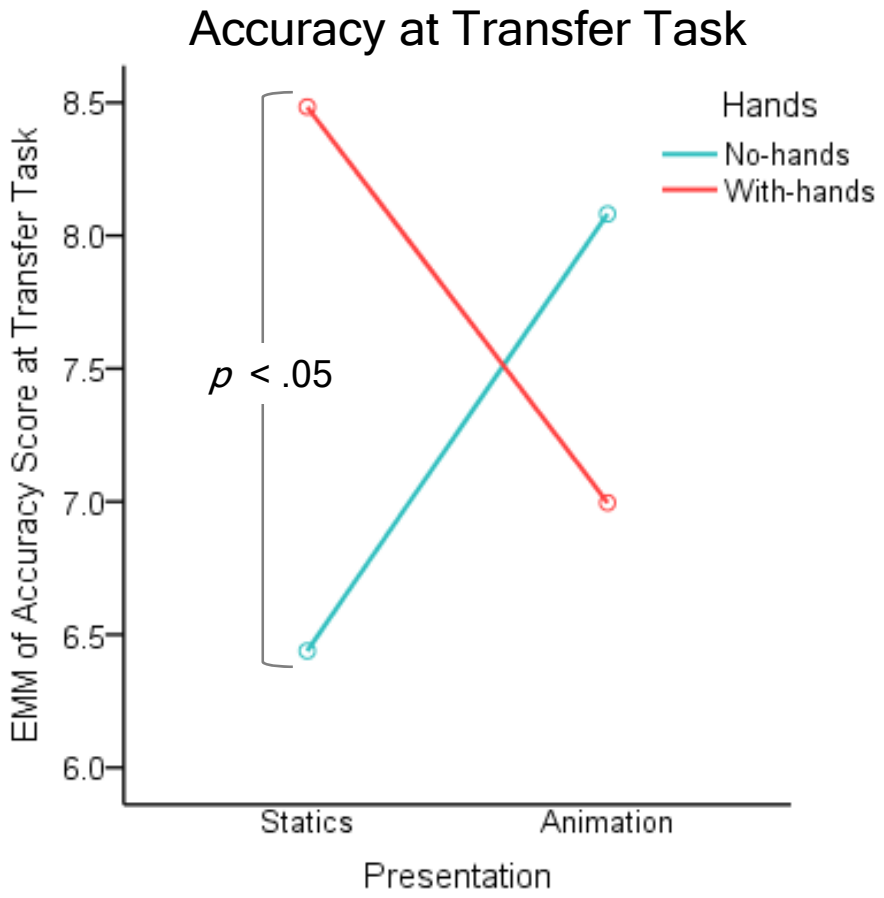
Results

with-hands/statics
EMM = 8.60

no-hands/animation
EMM = 8.01

with-hands/animation
EMM = 6.85

no-hands/statics
EMM = 6.54



Experiment: Non-Manipulative Task

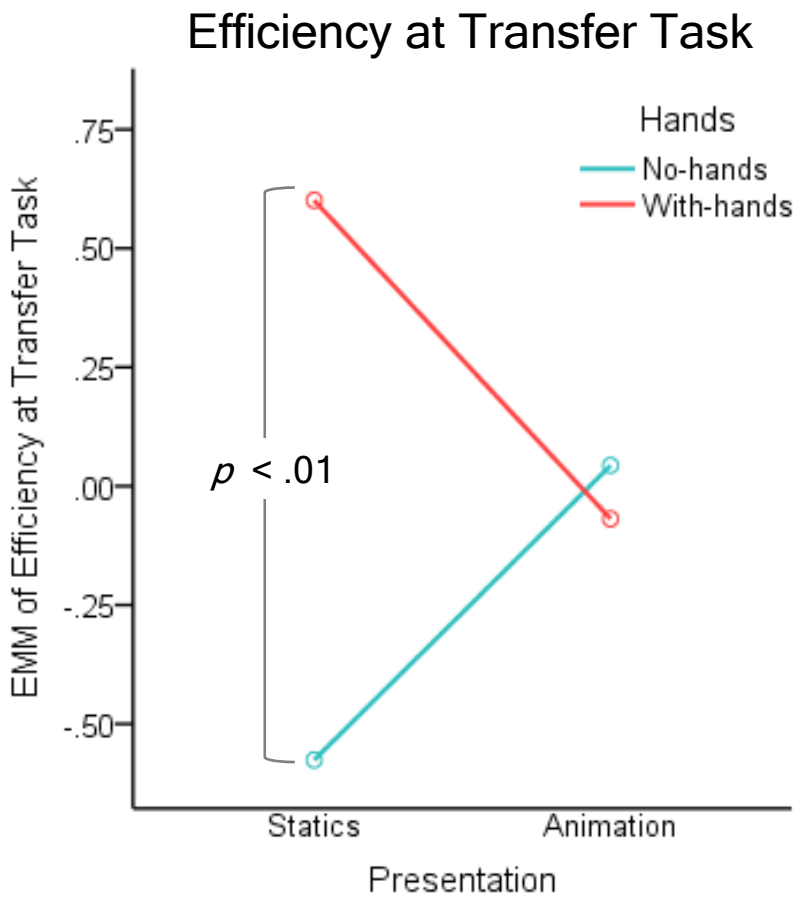
Results

with-hands/statics
EMM = 0.66

no-hands/animation
EMM = 0.04

with-hands/animation
EMM = -0.17

no-hands/statics
EMM = -0.53



Experiment: Non-Manipulative Task

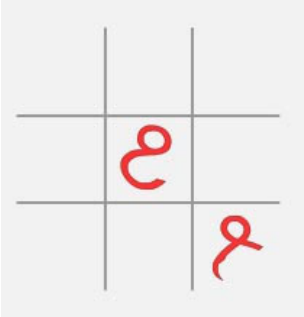
Conclusions

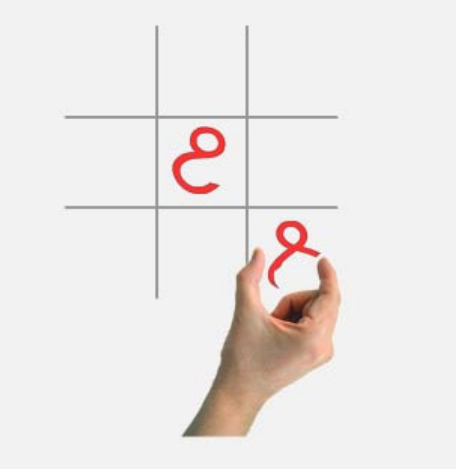
1) Hand Effect:

   Statics with Hands are better than Statics without Hands

   Animation with Hands may be worse than Animation without Hands

2) Hand versus Redundancy effects





Instructional Implications

Non-manipulative tasks

- Static pictures that show hands may be better than static pictures that do not show hands
- Animations that do not show hands may be better than animations that show hands

References

Ayres, P., & Paas, F. (2007). Making instructional animations more effective: A cognitive load approach. *Applied Cognitive Psychology, 21*(6), 695-700.

Ayres, P., Marcus, N., Chan, C., & Qian, N. (2009). Learning hand manipulative tasks: When instructional animations are superior to equivalent static representations. *Computers in Human Behavior, 25*(2), 348-353.

Brockmole, J. R., Davoli, C. C., Abrams, R. A., & Witt, J. K. (2013). The world within reach: Effects of hand posture and tool use on visual cognition. *Current Directions in Psychological Science, 22*(1), 38-44.

de Koning, B. B., & Tabbers, H. K. (2011). Facilitating understanding of movements in dynamic visualizations: An embodied perspective. *Educational Psychology Review, 23*(4), 501-521.

Marcus, N., Cleary, B., Wong, A., & Ayres, P. (2013). Should hand actions be observed when learning hand motor skills from instructional animations? *Computers in Human Behavior, 29*(6), 2172-2178.

Meltzoff, A. N., & Moore, M. K. (1977). Imitation of facial and manual gestures by human neonates. *Science, 198*(4312), 75-78.

Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27*, 169-192 .

van Gog, T., Paas, F., Marcus, N., Ayres, P., & Sweller, J. (2009). The mirror neuron system and observational learning: Implications for the effectiveness of dynamic visualizations. *Educational Psychology Review, 21*(1), 21-30.

Wong, A., Marcus, N., Ayres, P., Smith, L., Cooper, G. A., Paas, F., & Sweller, J. (2009). Instructional animations can be superior to statics when learning human motor skills. *Computers in Human Behavior, 25*(2), 339-347.