UNIVERSITÉ DE GENÈVE

CLEAP

Collaborative Learning from Animated Pictures

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Effects of collaboration in the context of learning from animations

Rebetez Cyril, Sangin Mirweis, Bétrancourt Mireille, Dillenbourg Pierre

Abstract

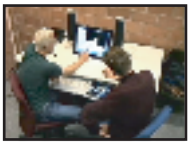
This study takes place between collaborative learning with the use of animated graphics, and questions relative to the use of animated graphics themselves. Indeed, both of those topics have in common empirical research proposing cognitive load as a slow down to efficient learning in those conditions. We proposed to pairs and single learners to follow animated or static materials. Moreover, we gave the opportunity to half of the participants to benefit of snapshots presenting the critical steps of the processes. Our hypothesis were that those snapshots could lower the cognitive load in all conditions, supporting the limited short-term memory and also grounding for duos.

The results presented here showed a benefit of animation but only pairs elaborated a better dynamic mental model than single learners when watching animated content. Single learners were also disadvantaged when not provided with snapshots, but pairs lost their advantage when using them. We assume this was due to redundancy in the cognitive support. Cognitive aid seems necessary to improve the benefits of animated content but too much aid is not positive. Visuo-spatial skills of participants are a very good predictor of success whatever the condition.

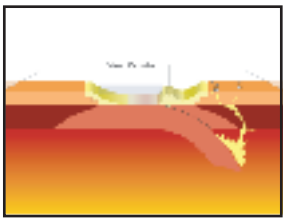
Method

Participants are 160 French-speaking students from the university and from the institute of technology. we used a 2 X 2 X 2 between-subjects design. Factors are :

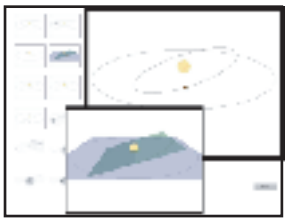
- **Collaboration** (solo / duo) for learners viewing the materials alone or in group of two.
- **Permanence** (with / without), whether the snapshots are presented or not.
- **Animation** (static / dynamic) whether each material was a series of 12 graphics or a series of 12 animations.



80 participants over the 160 were following the instructional material in pairs. The retention and transfer tests were passed individually.



For both materials, 12 animated sequences (dynamic condition) or 12 graphics (static condition) were presented with an audio commentary.

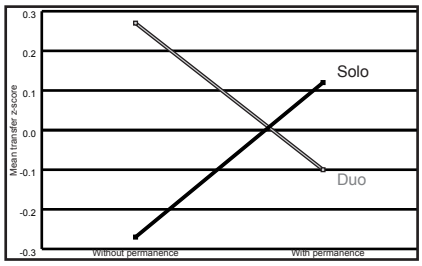


In conditions with permanence, a new thumbnail (left) was appearing after each one of the 12 parts. They allowed access to a bigger snapshot (bottom center).

Procedure

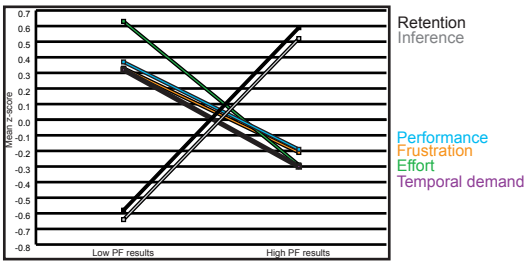
- Participants in the solo condition use a computer to answer a quick knwoledge test about astronomy
- Material corresponding to the experimental condition is shown, accompanied with an audio commentary (venus transit explanation). Time for reflexion is allowed between every of the 12 parts.
- A simplified version of the NASA-tlx is answered followed by two questionnaires. A retention and a transfer test (9 and 7 multiple choice questions).
- The experiment starts again explaining this time the geological phenomenon of rift and subduction.
- In the end, participants have to fill a computer version of the Corsi blocks and the paper-folding test.
- Participants following the duo condition have almost the same procedure as solos, but they watch the material in pair, on the same screen. The questionnaires are still filled individually. Pairs don't have to answer the Corsi-blocks and paper-folding tests in the

Permanence and collaboration effect on the transfer test



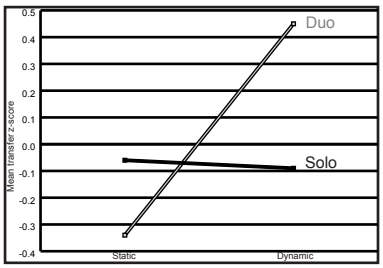
Permanence and collaboration conditions ($F_{(1;159)}$=6.73; p=.01) show an interaction. Without permanence, pair learners are more able to transfer their knowledge than participants who learned in single (20% score difference).
With permanence, The differences between solo and duo disapear. Single learners take benefits of thumbnails and snapshots. The working memory resources aren't as much used to remember the whole process and more resources can be allowed to elaborate the dynamic mental model. On the other hand collaborating pairs don't take advantage of

Mental rotation skills, learning and perceived cognitive load



Whe splitted the participants in two groups depending on thier visuo-spatial performance: People with high visuo-spatial skills are better to retain information and to transfer their knowledge ($F_{(1;79)}$=36.12 and 37.02; p<.001). They also perceive less difficulty and less cognitive load ($F_{(1;79)}$=5.88 to 17.64; p=.018 to <.001).
We witnessed no interaction between paper-folding level and animation variable nor permanence variable. High-leveled are just better and more confident whatever they see. As only participants working single had to perform the paper-folding test, these results don't apply to peers.

Animation and collaboration effect on transfer test



The effect of animating the content is positive for transfer, but only for people working in pairs ($F_{(1;159)}$=7.65; p<.01). Single learners didn't achieve better whether the material was static or dynamic. Only pairs, both watching and discussing, find the full potential of animations. These results differs from those found by Schnotz et al. (1999).

Conclusion

The higher scores of participants with high mental rotation skills are nothing new (Gyselinck et al., 2000) but we expected our conditions to facilitate the learning of low-skilled people (especially the permanence condition) which is not the case. These results confirm the difficulty of learning from animated graphics and even from static graphics.

Our results suggest the use of animated graphics as positive for learning but only with a cognitive aid. An external help such as collaboration is more useful than internal help (permanence of anterior states) but using both aids is not cumulative. This suggest a kind of split-attention (Sweller & Chandler, 1994): The participants had to manage the interaction with the interface and with their co-learner, increasing needlessly the external cognitive load. this effect could be called "split-interaction". Further studies of the recorded interactions will help us confirming this hypothesis.

Gyselinck, V., Ehrlich, M.-F., Cornoldi, C., de Beni, R., & Dubois, V. (2000). Visuospatial working memory in learning from multimedia systems. journal of Computer Assisted Learning (2000), 16, 166-176.
Schnotz, W., Böckheler, J. & Grzondziel, H. (1999). Individual and co-operative learning with interactive animated pictures. European Journal of Psychology of Education, 14, 245-265.
Sweller, J., & Chandler, P. (1994). Why some material is difficult to learn. Cognition and Instruction., 12, 185-233.

Research project funded by the Swiss National Science Foundation (Grant # 11-68102.02)