

Introduction

Exploring a new way to do collaborative concept mapping around an interactive tabletop.

- This research is focused on taking the educational technique of concept mapping, as proposed by Joseph Novak, and applying it to a multi-touch tabletop context. The aim is to promote collaborative learning, in a task which would traditionally be performed individually.
- Concept mapping was originally conducted on paper, then tools were developed to extend this experience to the desktop computer, my research aims to move this experience to a natural user interface, specifically the interactive tabletop. It is expected that this new setting shall encourage group interaction and therefore produce a more effective learning experience.
- Specifically, the system aims to provide a more effective means of collaborative concept mapping than a desktop equivalent.

Aims

This research aims to:

- Exploit affordances of multitouch hardware (interactive tabletop) in promoting co-located collaboration.
- Address challenges in handling simultaneous input from multiple users.
- Utilise touch as a means of intuitive input requiring limited background experience to master.
- Present a novel application for natural user interfaces in education.
- To electronically gather data from evaluation testing.

Benefits of collaboration

- Externalising knowledge as a group
- Promotes discussion and negotiation of differences in opinion.

Benefits of tabletop for concept mapping

- Large working area
- Good for young people
- Supports collaboration

Challenges

- Orientation of text to allow viewing by multiple people
- Orientation of entire map
- Allowing simultaneous interaction from multiple members of the group
- Distinguishing different actions with similar gestures
- Identifying individuals within a group
- Verifying student maps against expert map
- Providing feedback to students
- Tracking progress
- Handling large maps

Limitations

- Inability of the hardware to link touch events to individuals
- Limited input (no keyboard), no roll over action.
- No established design guidelines

User View

- Upon starting the application, the user is presented with a blank work area (circular) in which to construct their concept map.
- A hold gesture is used repeatedly through the application both to create new concepts and to trigger object-specific context menus.
- To construct a complete map, one must first create concepts, next arrange them and then begin linking.
- Linking may be unidirectional or bidirectional and may also branch as demonstrated.
- Linking is triggered by the "link" option in the concept menus.
- To encourage collaboration, both co-located users share a single work area which may be rotated and which orients all text outward from the centre.

Evaluation

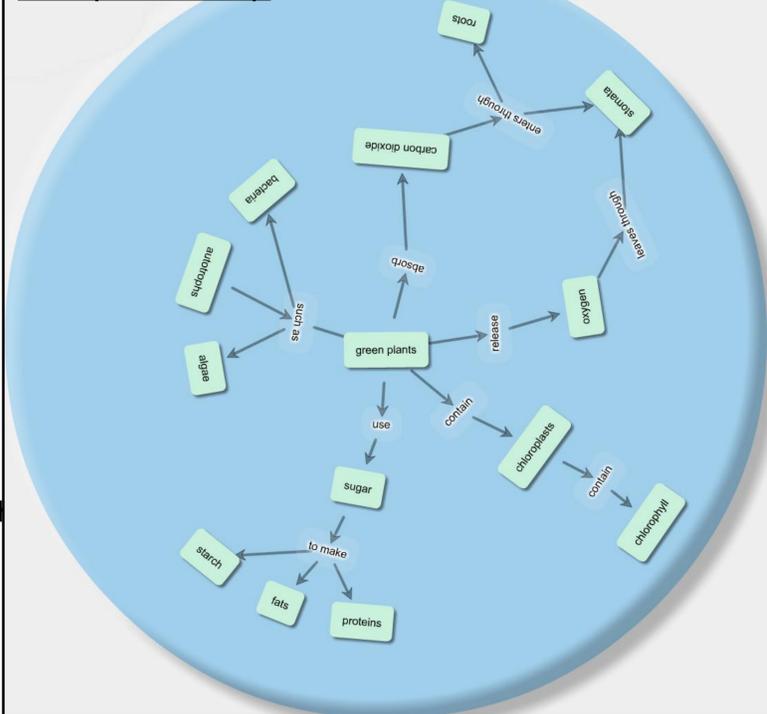
- The primary goal of this evaluation is to determine the effectiveness of TouchMapper as a tool for co-located collaboration in concept mapping tasks. This is assessed through a comparison with CMapTools, an established digital concept mapping tool.
- Data logging and video analysis shall be performed to obtain results.
- Usability testing is to be performed with years 6 students of St Pius X College, Chatswood.

Contributions

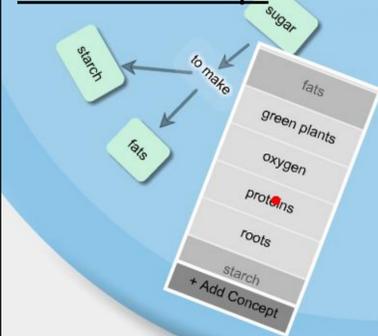
Design – Implementation – Evaluation

- Design and implementation of a novel tabletop user interface that supports collaborative concept
- Exploration of multiple approaches to designing the interface, based on prototyping and discount usability evaluations.
- Concept mapping through simultaneous interaction by multiple group members.
- A detailed qualitative evaluation that compares the implemented collaborative concept mapper with an existing solution for concept mapping on year 6 students.
- A detailed analysis of evaluation results to determine the effectiveness of the designed application at promoting collaboration
- A detailed analysis of existing research in a areas of collaborative tabletop interaction, collaborative

Completed Map



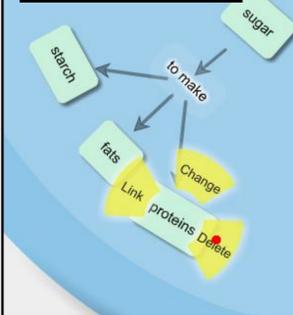
Create Concept



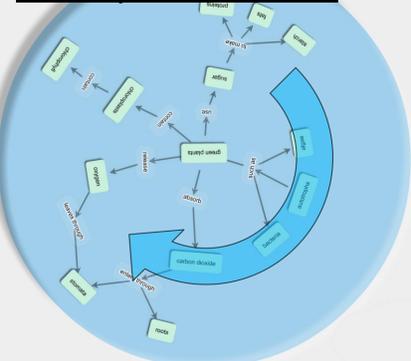
Create Link



Context Menu



Workspace Rotation



References

1. Cimolino, L. & Kay, J. (2002), Verified Concept Mapping for Eliciting Conceptual Understanding, in 'ICCE'02: Proceedings of the International Conference on Computers in Education', IEEE Computer Society, Washington, DC, USA, pp. 1561.
2. Novak, J. D. & Cañas, A. J. (2006), 'The Theory Underlying Concept Maps and How to Construct and Use Them', Technical report, Florida Institute for Human and Machine Cognition, Pensacola FL. 3. Do-Lenh, S.; Kaplan, F. & Dillenbourg, P.
3. (2009), Paper-based concept map: the effects of tabletop on an expressive collaborative learning task, in 'BCS HCI '09: Proceedings of the 2009 British Computer Society Conference on Human-Computer Interaction', British Computer Society, Swinton, UK, UK, pp. 149--158.
4. Hilbert, T. & Renkl, A. (2008), 'Concept mapping as a follow-up strategy to learning from texts: what characterizes good and poor mappers?', Instructional Science 36(1), 53--73.
5. Lao, S.; Heng, X.; Zhang, G.; Ling, Y. & Wang, P. (2009), A gestural interaction design model for multitouch displays, in 'BCS HCI '09: Proceedings of the 2009 British Computer Society Conference on Human-Computer Interaction', British Computer Society, Swinton, UK, UK, pp. 440--446.
6. Rogers, Y.; Lim, Y.-k.; Hazlewood, W. R. & Marshall, P. (2009), Equal Opportunities: Do Shareable Interfaces Promote More Group Participation Than Single User Displays?, in , pp. 79 - 116.
7. Vernier, F.; Lesh, N. & Shen, C. (2002), Visualization techniques for circular tabletop interfaces, in 'AVI '02: Proceedings of the Working Conference on Advanced Visual Interfaces', ACM, New York, NY, USA, pp. 257-265.