TEDR PROGRAMME

	09:00-09:15	**Registration**		
	09:15-09:30	Opening session		Richard Cox
Workshop Session 1	**09:30 -10:00**	Oral Session 1	Processing static and dynamic diagrams: Insights from eye tracking	Richard Lowe and Jean-Michel Boucheix
	10:00-10:30	Oral Session 2	Eye Tracking in Multimodal Comprehension of Graphs	Cengiz Acarturk and Christopher Habel
	10:30-11:00	Q & A followed by	Interactive session	
	11:00-11:30	Morning Break		
Workshop Session 2	**11:30-12:00**	Oral Session 3	Eye-tracking and learning interactions from graphs and diagrams	Jonathan P. San Diego
	12:00-12:30	Oral Session 4	Comparison of Haptic and Non-Speech Audio Feedback	Cagatay Goncu and Kim Marriott
	12:30-13:00	Q & A followed by	Interactive session	
	13:00-14:15	Lunch		
Workshop Session 3	**14:15-14:45**	Oral Session 5	Design of a Virtual Reality System for the Study of Diagram Use in Organic Chemistry	Andrew Stull, Trevor Barrett and Mary Hegarty
	14:45:15:15	Oral Session 6	An infrared finger tracking system for graphing applications	Grecia Garcia Garcia and Richard Cox
	15:15-15:45	Q & A followed by	Interactive session	
	15:45-16:15	Afternoon Break		
	16:15-16:45	Open Forum	**Discussion about the Oral sessions**	
	16:45-17:15		**Discussion about the Interactive sessions**	
	17:15-17:30	Closing		

Oral Session 1: Processing static and dynamic diagrams: Insights from eye tracking

Authors: Richard Lowe* and Jean-Michel Boucheix

Keywords: eye tracking; diagram processing; static and dynamic graphics; data collection combinations; varied examples

Abstract:

Empirical studies of static and dynamic diagrams have traditionally collected outcome data indicating the effectiveness of these depictions with respect to comprehension and learning. Because outcome measures alone provide limited insights as to why diagrams are or are not effective, there has been growing interest in studying how people process these depictions. In some cases, the aim of this research is to develop principled approaches for guiding diagram design while in others it is to devise strategies that could support users. This paper presents a selection of examples from varied content domains illustrating how eye tracking data can be combined with other measures to probe how users interact with diagrams. Descriptions of the systems used in these combinations will be described and the synergies between eye tracking and the other measures explained. The illustrations are selected from studies in which the goals ranged from exploring the effects of cueing to comparing visual and haptic search. These different examples show that approaches used for analysing and interpreting eye tracking data need to be carefully matched to the specific goals of individual studies. We conclude with recommendations for using eye tracking as an adjunct to other approaches for gathering diagram processing data.

Oral Session 2: Eye Tracking in Multimodal Comprehension of Graphs

Authors: Cengiz Acarturk and Christopher Habel

Keywords: eye tracking, statistical graphs, line graphs, multimodal comprehension

Abstract:

Eye tracking methodology has been a major empirical research approach for the study of online comprehension processes in reading and scene viewing. The use of eye tracking methodology for the study of diagrammatic representations, however, has been relatively limited so far. The investigation of specific types of diagrammatic representations, such as statistical graphs is even scarce. In this study, we propose eye tracking as an empirical research approach for a systematic analysis of multimodal comprehension of line graphs. Based on a framework of multimodal comprehension of graphs and texts, which focuses on the role of spatial concepts, we present an experimental investigation of linguistic guidance and eye movement control in comprehension of time-domain line graphs with a particular focus on the analysis of gaze patterns in graph inspections.

Oral Session 3: Gazes, actions, utterances, sketches – analysing learning interactions with computer-based representations

Author: Jonathan P. San Diego* and James C. Aczel

Keywords: Representation, strategic theories, Problem-solving, HCI, eye-tracking

Abstract:

Studies into the effects of computer-based representations on learning have been inconclusive and two of the possible reasons have been related to the different ways the representations are instantiated (e.g. static, dynamic, interactive, etc.). A study was conducted – consisting of video data of learners' use of representations including graphs and diagrams during problem solving – to identify which representation is being considered by learners as utterances are made, and to examine more closely learners' movement between representations. This research focuses on the relationship between learning strategy and the use of representations during learners' problem solving. Rich data were collected using a variety of technologies including eye-tracking, screen capture software, logs of computer operations, digital camcorders and a tablet PC. The application of this novel combination of data capture techniques allowed detailed analysis that related what learners say, do, see, and write during problem solving. A framework of strategies was derived, and applied to tease out how varying computer based representations influences strategy and how strategy choice changes over the course of mathematical problem solving.

Oral Session 4: Comparison of Haptic and Non-Speech Audio Feedback

Authors: Cagatay Goncu and Kim Marriott

Keywords: graphics, usability, accessibility, haptic, audio, multi-touch

Abstract:

We report a usability study which investigated the use of haptic versus non-speech audio interface to identify different geometric shapes. The study used simple graphics containing one to three geometric shapes (line, triangle, rectangle and circle).We presented the graphics to 11 participants in two different modes audio and haptic in a counter-balanced design. The participants were asked to identify the number and the types of the shapes. Error rates with audio and haptic feedback were very similar. The time to answer the overview task was generally faster with audio feedback, however it was generally faster with haptic feedback for detailed view task. These results need to be considered with some care because they were not statistically significant because of the small number of participants.

Oral Session 5: Design of a Virtual Reality System for the Study of Diagram Use in Organic Chemistry

Authors: Andrew Stull, Trevor Barrett and Mary Hegarty

Keywords: Diagrammatic reasoning, representational competence, concrete manipulatives, virtual reality, organic chemistry

Abstract:

Organic chemists must be adept at relating different 2D diagrammatic representations of molecules while also understanding their 3D structure. Concrete (3D) models can aid students in developing these aspects of representational competence but a growing trend is to incorporate virtual 3D models into instruction. In this paper, we describe the design of a virtual reality system to investigate how students use virtual models, for learning about different structural diagrams common in organic chemistry. We follow with preliminary results of a study comparing the relative effectiveness of virtual versus concrete models. Participants performed tasks using either virtual or concrete models to match or to complete three different types of molecular diagrams. The preliminary results suggest a benefit of using virtual models over concrete models.

Oral Session 6: An infrared finger tracking system for graphing applications

Authors: Grecia Garcia Garcia and Richard Cox

Keywords: interactive environments, graphicacy, touch screen technology

Abstract:

The workshop presentation will describe a specialized application of Lee's "Wiimote Whiteboard" (Lee, 2012) an infra-red camera based tracking system which uses the Nintendo Wii wireless remote control unit and Bluetooth. Young students wear a very small infra-red LED on their index finger with a forefinger/thumb operated micro-switch for producing "mouse clicks". This system is combined with a vertically mounted data projector or a horizontally mounted regular computer LCD display, creating a cost-effective large interactive touch surface. The system has a fast response time and has been used with primary school students in diagrammatic knowledge (graphicacy) assessment (Garcia and Cox, 2010) and in interactive dynalinked diagrammatic applications (Garcia and Cox, 2010). These applications were designed to investigate the "graph-as-picture" misconception and they will be described and demonstrated at the workshop.