PhD Viva
Lancaster University
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A Visualisation Design for Sharing Knowledge
a virtual environment for collaborative learning support
- ViDESK -

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Thesis problem

• how to share knowledge between a group of people?
  • in particular
    people engaged in learning activities together
    in a higher education context
Support collaborative learning

• by considering cognitive overhead and information overload issues
  • **minimise cognitive overhead**: allow user understanding, confidence and feedback regarding its choices and decisions
  • **minimise information overload**: leverage the amount of information available to the user by providing representation facilities and customised detail

How to support collaborative learning

• ViDESK proposes the combined use of
  • a textual structure for knowledge sharing and
  • a visualisation design (composed by a two-part 3D interactive visualisation)
Work objectives - 1

• *support collaborative learning*
  • by providing a visualisation design to convey the structure information, and allow the knowledge represented by the structure to be shared among users

Work objectives - 2 and 3

• *minimise cognitive overhead*
  • by exploring the visualisation design, having an externalisation of a knowledge theme (context)

• *minimise information overload*
  • the visualisation deals with the information overload problem by offering a reduced set of symbols to generate the visualisation design
Experimental conclusions 1&2

- ease user interaction
  - provide a common interface independent of different knowledge themes
- provide a high abstraction level to describe a given knowledge context
  - allowing a high description level for use in collaborative learning to discuss models, concepts relationships and confront perspectives about a given knowledge theme

Experimental conclusions 3&4

- support data source analysis
  - based on a given structure for knowledge sharing by comparing the structure with data source information
- provide a context meta-description to analyse and compare different data sources
  - based on a given structure, allows the user support to start, generate and analyse data source results within a particular context

  further work need to be conducted to assess the extend of this advantage
Thesis contributions 1

- convey high-level abstract information by
  - using a structure to represent a knowledge context to be shared and enhanced collaboratively and
  - a 3D interactive visualisation to convey structure information

Thesis contributions 2

- a generic support to convey knowledge information for collaborative learning

  allowing the use of ViDESK to support collaborative learning
demonstrates the use of a 3D interactive visualisation for integrating knowledge sharing and collaborative learning
Thesis contributions 3

• provide integration between knowledge and a data source in the same interface

  using ViDESK to support content data source analysis regarding a particular context specified by a structure for knowledge sharing

Thesis contributions 4

• evaluate and design experiments to assess the visualisation design for sharing knowledge system

  using both quantitative and qualitative evaluation techniques
Future work

• **experiment 1**
  • assess how an expert can use a structure for knowledge sharing to specify a knowledge theme, including the use of the concept space visualisation to represent it
  • assess how users can explore and use the structures constructed by the experts
  • redevelop the concepts spatial positioning specified for the visualisation in order to assess its impact in the visualisation and how experts organise it

Future work

• **experiment 2**
  • how a user can explore the knowledge theme using visualisation design and the ViDESK system
  • analyse data gathered about how structure content can be explored and why participants propose the concepts they propose
  • study the impact of user contributions in the concept space visualisation by allowing users to explore the relations of their contributions with the existing structure
  • study the impact of using the visualisation design to answer complex problems about the knowledge theme
  • study the criteria space utility and the Information Visualisation facility
Future work

• **experiment 3**
  • how ViDESK system can be used to support collaborative learning by allowing a group to enhance a structure for knowledge sharing
  • analyse collected data from observing participants interaction using the ViDESK system
  • analyse navigation on the concept space, the criteria space visualisation and the chat conversations
  • involve more participants in order to confirm reported results and compare questionnaire and task results with the participants' computer and subject expertise.

Future work

• **ViDESK development**
  • adopt the use of more advanced hardware interfaces as 3D input devices for navigation and 3D glasses or other output devices designed to support virtual environments
  • improve network support and visualisation refreshing for better response times, which, in turn, can augment system functionality
  • improve the input data for the concept location exploring the 3D spatial positioning taking advantage of the already available absolute and relative positioning facilities
Future work

• ViDESK development
  • extend the criteria space visualisation to allow the use of multiple keywords and Boolean logic for composing each of the three possible criteria to render the criteria space
  • use of Dublin Core and other textual based classification systems to inform the Information Visualisation, allowing better content analysis for existing data sources
  • include gesture support in the voting tool by sensing users' rising hand actions, leading to a more integrated user interface, involving users and focus them in the structures enhancing and not in the voting process

Future work

• applications for using VideoSk
  • Information Retrieval support: take advantage of the ViDESK Information Visualisation, to analyse and compare the knowledge theme with information from a given data source or a set of data sources
  • Integrated Learning Environments are composed by a set of integrated tools to assist learning activities and content access for a number of users. ViDESK can be used to complement content requirements within a particular context given by the structure for knowledge sharing
Future work

- applications for using Videsk
  - Workflow: learning about a particular working environment. Help new workers learn about the working context and detail about the way information is used
  - Knowledge Management: using additional annotation facilities and a recommender system, ViDESK can be extended to assist knowledge management
  - Content Management: as a visual interface for content management allows the existence of different views independently from the content itself

Conclusions

- the structure for knowledge sharing:
  - supports the representation of a knowledge theme, which provide contexts that can be used in a higher education setting
  - can be used to share context knowledge and the 3D interactive visualisation as an interface for enhancing a context by a group of people
- the system can be used to enhance collaboratively the structure to express the group view
  - the visualisation design can be used to convey structure information providing a feasible interface for individual user exploration and group sharing
Conclusions

• further research work needs to be undertaken but:
  • preliminary results seem to confirm most of the work objectives presented
  • the use of 3D interactive visualisation proved to be feasible to support the sharing of knowledge
  • the use of a virtual world allows representing high-level abstract information
  • users should interact with the visualisation design to assist them on comparing data source information with the knowledge theme being shared. This can provide a potential tool for comparing different data sources based on a given knowledge context allowing semantic data source analysis

Conclusions

• a final remark
  • using 3D facilities as a new form to deal with high abstraction information
  • the creation of such "representation languages" can be seen as a promising research field
  • ViDESK can hopefully be considered a small contribution
Recommendations

• about the visualisation research area:
  • Visualisation has a huge potential as a high-level integration interface.
  • regarding information and knowledge, visualisation benefits and potential remains mostly undiscovered
  • the creation of virtual environments for representing information and knowledge requires a multidisciplinary approach
  • the research can benefit from taking into consideration education issues

Recommendations

• based on the development work:
  • use of Java and Java based technologies for prototype development: reuse of many available technologies, easy to use and as an inexpensive alternative, widely documented and easy to run and test (hw and sw)
  • minimise the use of state-of-the-art hardware: for testing virtual environments, special devices can be an advantage, but they also present difficulties to the development such as platform restrictions and lack of support
  • when possible use the World Wide Web as the testing data: the Web provides a unique data set with multimedia and unstructured information as well a rich set of formats and contexts to be used
Recommendations

• based on the evaluation work:
  • for evaluation adopt a task strategy; as visualisation and virtual environments evolve, a high number of issues remain unsolved. The use of tasks for evaluation focuses the activity and facilitates both the evaluation and data gathering
  • focus on user emotion activators instead of processes; each student has its own motivation and learning trigger. To be engaged he/she must be “touched” and be able to work with information and knowledge. There is no unique and secure process for making someone learn: one of the best ways is to promote interaction between students

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