# 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 Videsk
  - **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
    *it seems as a better way for organising information and knowledge*
  - 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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