SEMANTIC AND CONCEPTUAL STRUCTURES IN MODULE DESIGN

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ABSTRACT

This paper describes the employment of semantic and conceptual structures in module design, specifically course modules. Additionally, it suggests other uses of these structures in aiding teaching and learning.

Keywords

Semantic and Conceptual Structures, Module Design, Teaching and Learning.

1. INTRODUCTION

Graph and Network representations have a long history. Selz [6] pioneered work, using graphs to represent concept hierarchies and inheritance properties.

"There is psychological evidence that in addition to their ability to associate concepts humans also organize their knowledge hierarchically, with information kept at the highest appropriate levels of the taxonomy" [5].

This evidence was exhibited in experiments by Collins and Quillian in 1969 [1], who modelled human information storage and management using a semantic network. By providing a means of explicitly representing relations using arcs and nodes, graphs have therefore proved to be an ideal vehicle for formailising associationist theories of knowledge, and have long been used in psychology to represent structures of concepts and associations.

The term semantic network encompasses a family of graph-based representations. They represent knowledge as a graph, with the nodes corresponding to facts or concepts and arcs to relations or associations between concepts, nodes and links are generally labelled. Networks with the inclusion of appropriate inference rules can be used to answer a range of questions on the topic represented. These inferences are made by following links to related concepts. Semantic networks also implement inheritance [2] [5].

The influence of these representation schemes is evident in many applications, from natural language processing to objects. Topic and Mind Maps are recognised as being able to assist the learner to identify, organise, and manage key concepts and extend the learner's mind with graphic form [3].

2. METHOD

Semantic and conceptual structures, such as topic maps, provide a simple and highly beneficial means of constructing a well structured and organised content plan, when designing new course modules or revising existing ones. In this instance, explanation is best achieved through example. The example provided is for a course on "Human-Computer Interaction and Interaction Design".

3. RESULTS

Human-Computer Interaction and Interaction Design (HCI & ID) is the overall topic and therefore the top node in the map. The title node will also relate to an introductory lecture on the topic. The next nodes are a further breakdown, but still at a high level: Theory and Practice. In consideration of the two main areas, the network is extended to expand upon these. Figure 1 shows the map for the HCI & ID module. Figure 2 gives the lecture schedule derived from the map (Figure 1).

4. DISCUSSION AND CONCLUSIONS

The ease and simplicity of semantic and conceptual structures make them a powerful tool for module design. Course revision can be accommodated through the revision of the topic map, thus ensuring that the overall course structure and organisation is not compromised. Examples of course revisions (updates):

- AUIs and TUIs were added to the lecture on "The Senses".
- Other interaction paradigms, such as wearables, were added to the lecture on

"Conceptual Models and Interface Metaphors".

- Agents, etc were added to the second lecture on "Interaction Styles"

Getting students to attempt their own topic or mind map of the course can assist their revision, revealing the semantic map the course was founded upon after their attempts. The comparison between the students' and the tutor's maps could prove enlightening! In practice, the outcome of the comparison has been very positive, especially amongst the stronger students (as could probably be anticipated). However, all students found the exercise beneficial and a useful aid for revision.

There are many other applications that this technique is ideal for, in particular it has been found to be very effective in helping students to reason out the scope of their final year projects. Figures 3 and 4 suggest a template and an example of its application, respectively. The template suggested is likely to be generic to other projects.

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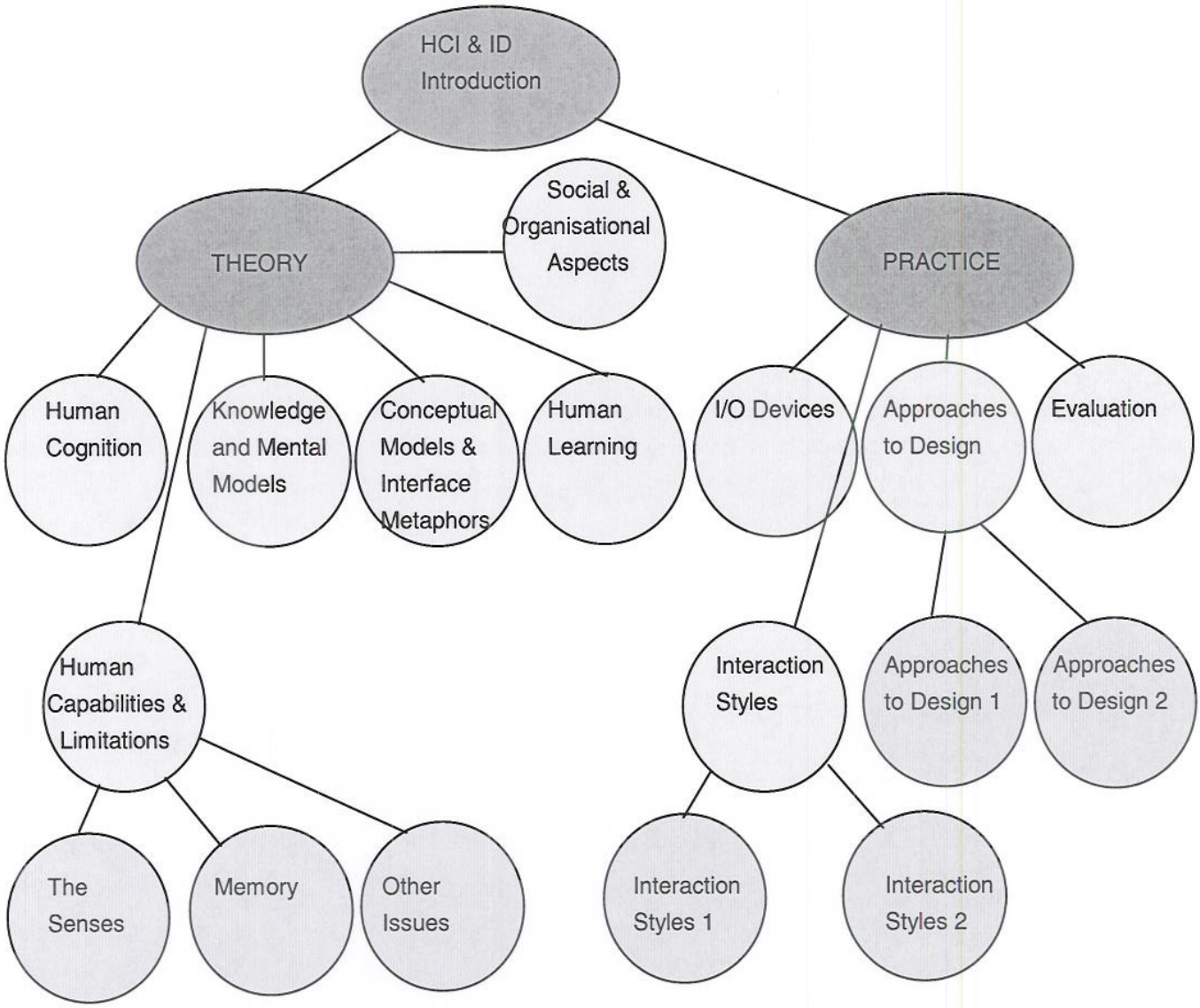

Figure 1 Topic map for "Human-Computer and Interaction Design" course module.

Lecture Topics

- Introduction
- Human Cognition
- Human Limitations and Capabilities: - The Senses
  - Memory
  - Other Issues
- Knowledge and Mental Models
- Conceptual Models and Interface Metaphors
- Human Learning
- Social and Organisational Aspects
- I/O Devices
- Interaction Styles 1 & 2: Command Driven; Menus; Question and Answer; Forms; Natural Language; Direct Manipulation
- Approaches to Design 1 & 2: Guidelines and Standards; Usability Engineering; Prototyping; Task Analysis
- Evaluation

Figure 2 Lecture schedule derived from Figure 1.

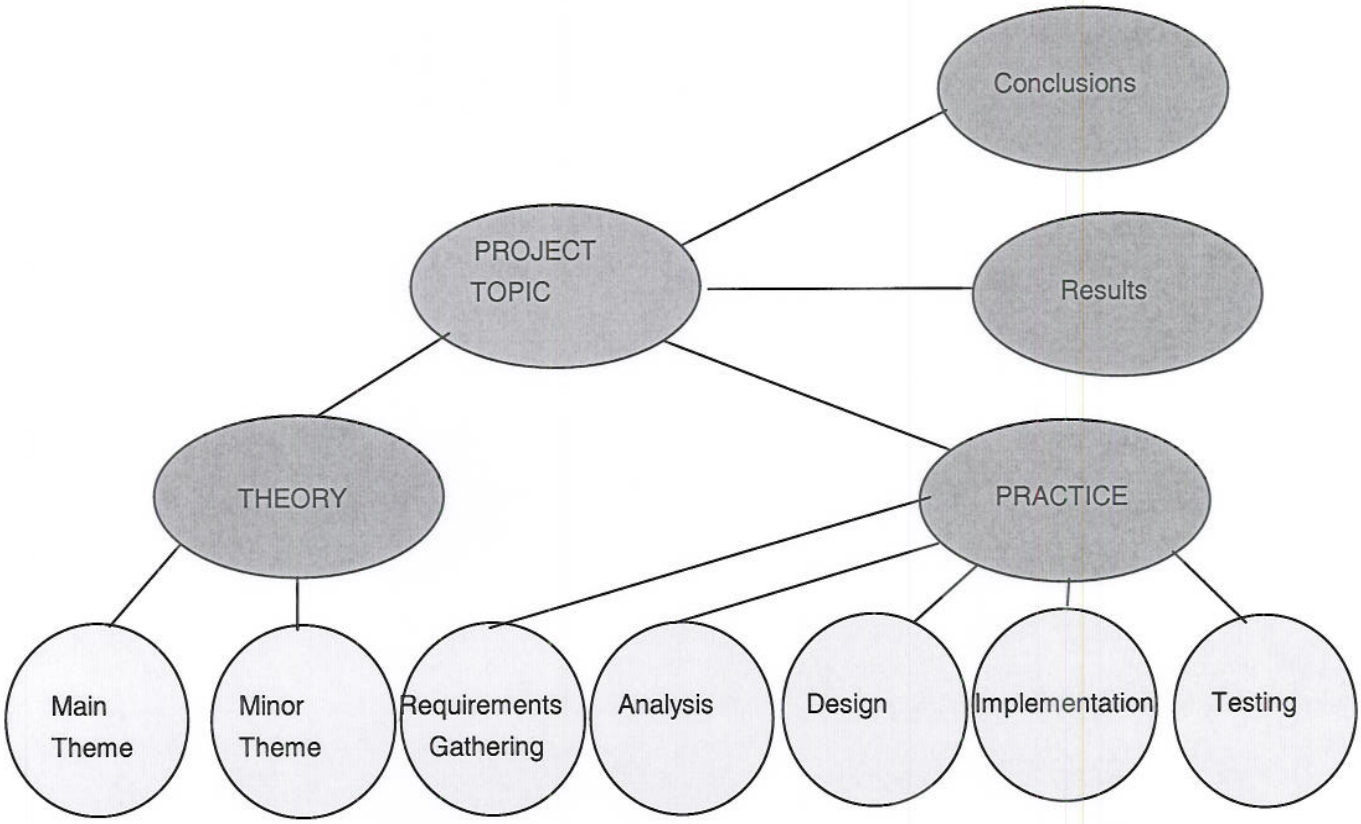

Figure 3 Topic map template for student final year project.

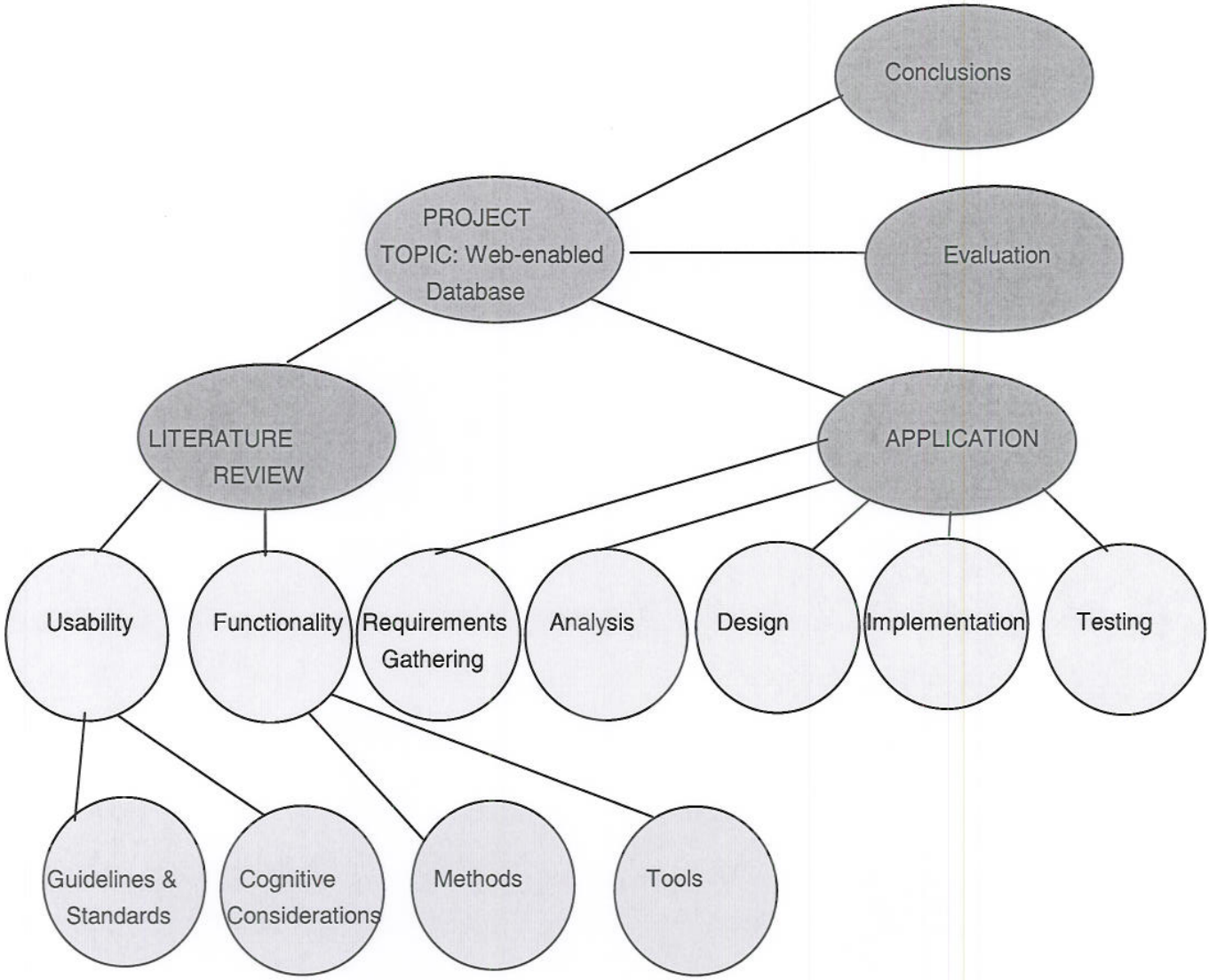

Figure 4 An example of an instantiated topic map for student final year project.