Modality Theory and Information Mapping

Overview and Summary of the Deliverable

Context

This Research Package is directed at the integrated development of Modality Theory, i.e., a systematic framework for the analysis of input/output modalities of information representation at the human-computer interface, and a methodology for applying the theory in practical interface design, called the Information Mapping Methodology. Modality Theory, including the software Taxonomy Workbench and Theory Demonstrator, is primarily being developed at CCI whereas ESADG has been engaged in interface design case studies in order to explore the requirements to be satisfied by an Information Mapping Methodology which could be applied in design practice. The Research Package was added to AMODEUS II in January 1994 at which point the CCI/ESADG collaboration had already been going on for some time.

Modality Theory explores input and output modalities as vehicles for the representation and exchange of information at the human-computer interface. Modality Theory may be viewed as belonging to a new generation of science-based theories in human-computer interaction (HCI) research, in the following sense. For 3-5 years or so, the importance of addressing the problems involved in bridging between basic theory and design practice has been high on the agenda of research in HCI. These problems are now seen as being both non-trivial and complex in their own right, and the need for 'bridging' representations between basic science and design practice is widely recognised. The Information Mapping Methodology is an integral part of Modality Theory and is being designed to serve as such a 'bridging' representation. Moreover, the basic concepts and the entire conceptual structure of Modality Theory itself has been conceived with design support in mind. The aim has been to let theory development be driven by practical (interface design) needs to the extent possible without sacrificing theoretical soundness and robustness.

Modality Theory has four broad parts, dealing with (i) output representations, (ii) input representations, (iii) information mapping and (iv) interface design support software, respectively. Except for input representations, these parts are all being addressed in the present Deliverable D14.

Output taxonomy consolidation

Our first aim by M2 has been to consolidate the taxonomy of unimodal output modalities. Consolidation requires at least a full theoretical development of the three major levels of the taxonomy, i.e. the super, generic and atomic levels including the required conceptual work. Consolidation results have been presented in two different ways: through papers and in the software Taxonomy Workbench and Theory Demonstrator (see next section). In the present Deliverable D14, the three first papers present consolidation results on the taxonomy of output modalities.

In Bernsen (1994a, cf. Sect. B below) the derivation of the taxonomy is described together with a characterisation of the super and generic levels of the taxonomy. Bernsen (1994b, cf. Sect. C below and Bernsen 1994c) presents the research agenda of Modality Theory and reviews results achieved. Bernsen 1994d illustrates conceptual work at the super level of the taxonomy.

Whereas the work just described has been mostly carried out during the second half of 1993, May (1994, cf. Sect. D below) illustrates consolidation work done during 1994 on the atomic and sub-atomic levels of the taxonomy. The paper which is on unimodal analogue atoms, illustrates a some of the general issues to be addressed by the work on output taxonomy. Thus, firstly, each of the 20 analogue atomic modalities are hypothesised to belong to one of 5 types, i.e. images, maps, compositional diagrams, graphs or conceptual diagrams. These types can therefore be analysed prior to their 'embodiment' in specific media as well as prior to considering whether they are static or dynamic. The same situation is found in the linguistic domain, where each of the atoms appear to belong to one of the types: text or discourse, labels/keywords or notation. Secondly, the paper illustrates systematic analysis at the atomic and sub-atomic levels. And thirdly, the paper illustrates the necessity of addressing 'border disputes' among prototype-based categories such as images, maps, compositional diagrams, graphs and conceptual diagrams. Work on analogue atoms is not yet complete, whereas the rest of the atomic modalities have been analysed and represented in the Workbench.

Workbench

Another important development during 1994 has been the complete re-design, at CCI, of the Taxonomy Workbench and Theory Demonstrator (Bernsen, Lu and May 1994, cf. Sect. E below, Lu, May and Bernsen 1994). The re-design covers scope, focus and functionality of the software. As a theory demonstrator, the software presents the taxonomy of output modalities in multimedia/multimodal hypertext documents. As a workbench, the software facilitates further exploration of the properties, functional and otherwise, of output modalities. In addition, this second version of the workbench is being related to the needs of the Information Mapping Methodology and the related requirements which must be satisfied by an interface design support tool developed on the basis of the present workbench. There are currently 134 modality and lexicon documents comprising some 150 Kb of (non-illustrated) text in the theory demonstrator.

Information mapping

The task of the Information Mapping Methodology is to serve as a bridging representation between basic modality theory and design practice. By means of case studies in which the still incomplete Modality Theory is being confronted with the realities of interface design practice, reasoning and problems, information can be fed back into Modality Theory development including information on the limitations on the claims which can legitimately be made on behalf of Modality Theory as to its design support potential. During 1994, two such case studies have been done of the application of the Information Mapping Methodology to practical design problems (Verjans and Bernsen 1994, cf. Sect. F below, Verjans 1994). Preliminary results of the former of these two studies suggest how more precisely to delimit the scope of output Modality Theory for the purpose of interface design support. Both case studies were completed recently and are currently being analysed. Further to the development of the Information Mapping Methodology, Steven Verjans' predecessor in the project at ESADG, Annick Bertels, has contributed a designer study done towards the end of 1993 (Bertels 1994).

References

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