FROM PAPER TO HYPERSPACE. REPRESENTING AND HANDLING KNOWLEDGE IN AN INTERACTIVE MEDIA ENVIRONMENT

Per Christiansson, Ph.D., Assoc. Prof.
Department of Structural Engineering
Lund Institute of technology. Lund University
Box 118, 221 00 Lund, Sweden
August 1991

Abstract

The systems we are formulating today may provide us with dramatically better communication tools as communication rooms, personal "telescreens", and virtual realities. Behind the system interfaces dwell more and more capable knowledge representations which are closely related to pertinent search strategies. What are the implications of the mutual influence between user demands and information technology? What will the properties and impact be of the next generations information handling system? It is now possible to create models which bring about a clearer and more obvious connection between the applications, our intentions and the computer stored models. As we mix knowledge representations which more or less formalize the models we create of our reality we can provide the users with specified views and tools on different levels of abstraction and degree of formalization. We must formulate and try out new concepts. New tools for building and using the next generation systems have been defined, created and tested at the KBS-MEDIA LAB (knowledge based system - media) at Lund University. Examples and scenarios are given at the symposium outgoing from projects carried through in the KBS-MEDIA environment which is shortly characterized as a multi agent environment with multimedia context dependent user interfaces to underlying facts bases.

Keywords

Communication; interactive media; agents; man-machine interaction; knowledge representation; hypermedia; artificial intelligence

Introduction

Information must onwards be regarded as a resource like labour, capital, property/product/material and energy. New system concepts for handling and representing knowledge must be formulated and tried out in theoretical and practical trials. It is very important that we try to transmit possible efficiency gains to something that will raise quality on both our work environment, cooperation possibilities and the end result of our efforts.

For example we can now focus on; dynamically establish net-

3rd International Symposium on "Systems Research, Informatics and Cybernetics". Baden-Baden, Germany. Agust 12-18, 1991

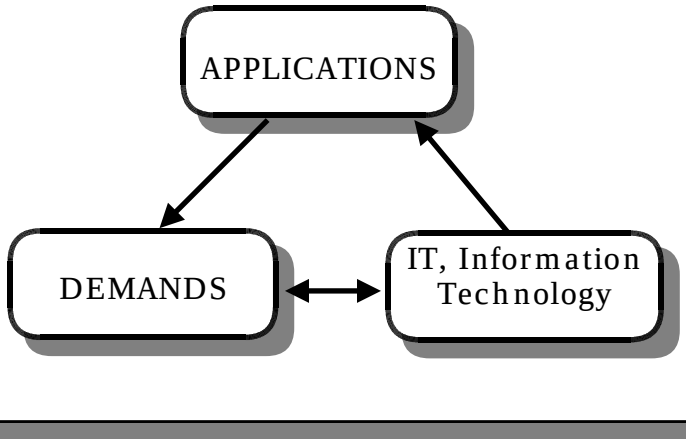

Figure 1. There is a necessary mutual influence between the applications and information technology domains for short and long term problem solutions.

works, access, collect and handle very large information volumes, define new tools to use, build, and maintain the systems, create new ways to define *detail levels*/resolution when accessing the models through "connectionist" thinking (that is to dynamically connect knowledge chunks in varying patterns), mix knowledge representations, create adapted user views, create easily understandable and interactive systems on application levels. See also figures 2-5.

Communication environment

From (Christiansson, 1990a). "The computer systems of tomorrow will contain huge and complex information volumes. Issues concerning communication with the systems will be very essential. We will be able to search *multi-dimensional* spaces (room, time, resolution, etc.), see figure 6. Dependent on who is interacting with the system and in what context it is done the *search mechanisms* will be different:"

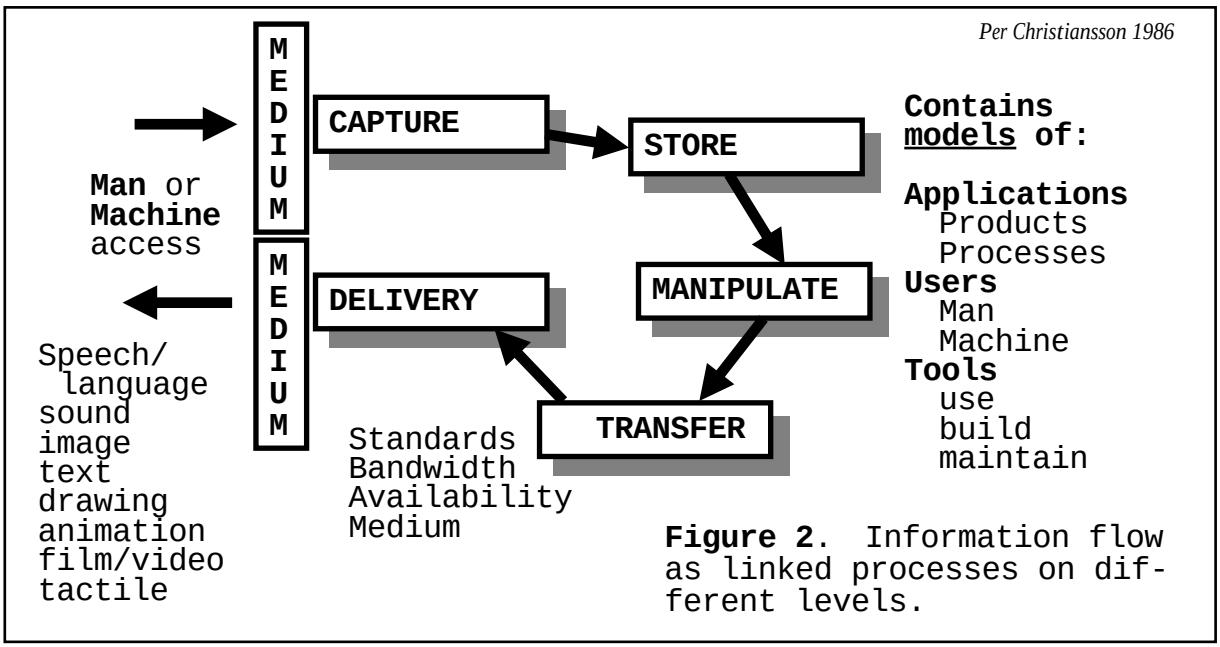

Figure 2. Information flow as linked processes on different levels.

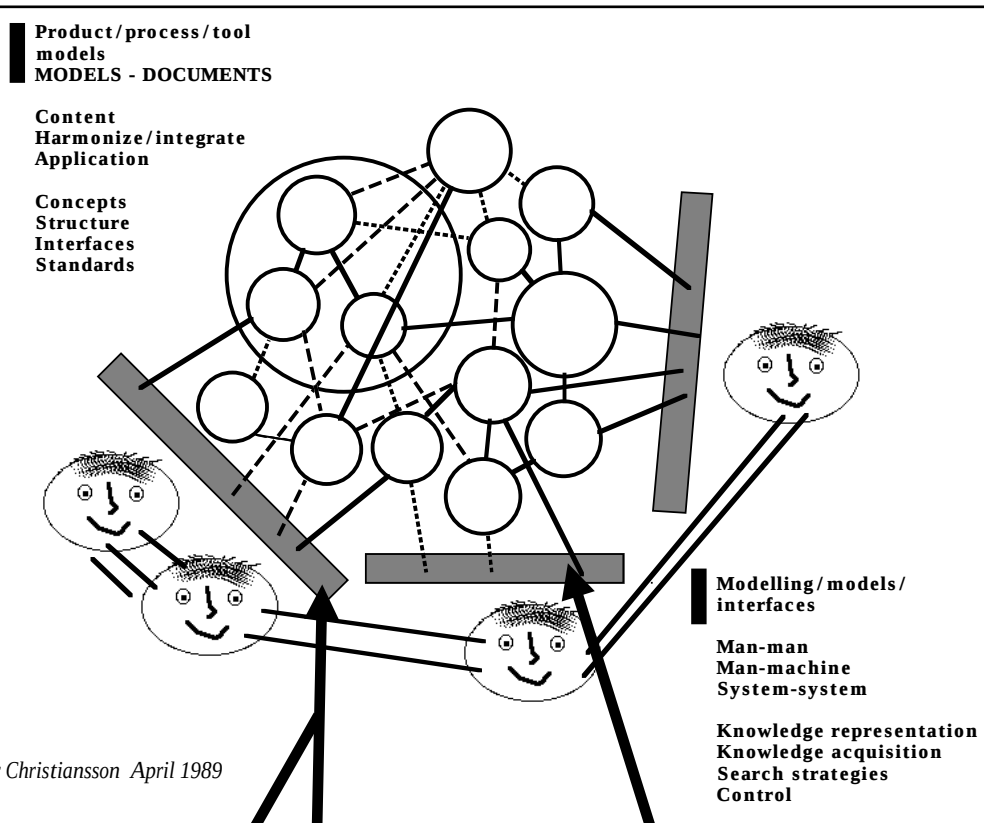

Figure 3. The hyperdocument may be regarded as a carrier of and interface to building process models. Different representations and search strategies will be used. From (Christiansson, 1990a).

Figure 4. Study of computer stored models in a multimedia environment. Intentions and demands are tested by design group and client. From (Christiansson, 1990a).

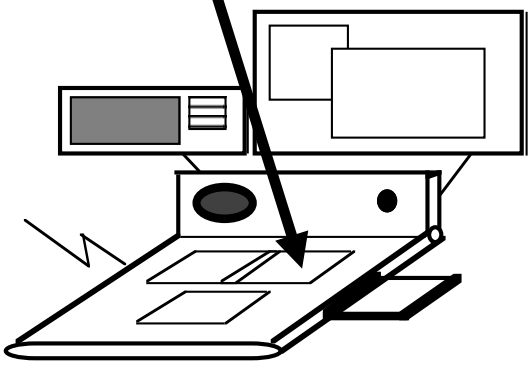

Figure 5. The personal "hyperdocument"/ "teledocument"/"telescreen" or whatever the unit will be called (cp. Dynabook/Alan Kay USA, Intelligent Note/Canon Inc.) will provide a powerful window to the computer resources. From (Christiansson, 1990a).

Multidimensional spaces:
room, time, resolution, ..
Media:
Text, sound, images, animations, speech,film,...
Search paths:
Alternative routes, tracking, analogies,..
Filters:
Zoom, perspective/fish eye, resolution,...
Help:
Agents, navgation/browse palettes, guided tours, information maps, experiences,...

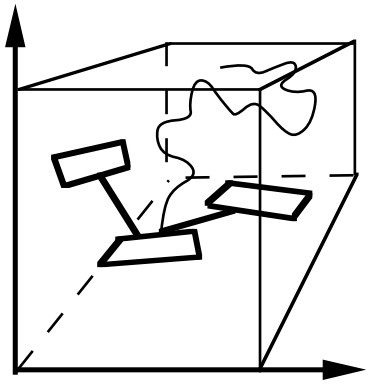

Figure 6. Search in huge and complex information volumes requires special tools and strategies. From (Christiansson, 1990a)

Formalizing knowledge

The higher the *degree of formalization* the more "effective" the

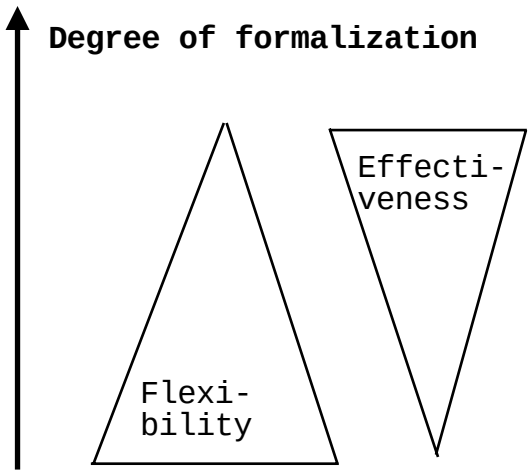

Figure 7. There might be a negative correlation between effectiveness and flexibility for different representations.

Optimizing in a set of constraints as:
- ease of system maintenance
- flexibility to new type of projects
- storing application experiences
- robustness of the model
- communication with other models
- degree of distributed models
- information content and volume. Modelling domains
- how is the information created and maintained
- style of communication (symbolic, pattern oriented, look at, augment the model etc.)

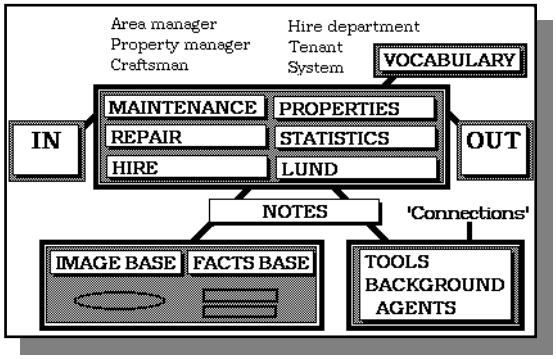

Figure 8. Logical structure of the 'DELPHI' demonstration system. Three layers can be seen: the context level with its different views (repair, hire, etc..) to the system, facts bases and tools/background agents with intermediate short-term memory/"note-book". From (Christiansson, 1990d).

model will be and less flexible to changes. It is of course a question about optimizing in a set of constraints as ease of system maintenance, and flexibility to new type of projects etc. (see also figure 7).

The KBS-MEDIA LAB

Since the autumn 1987 the author have been responsible for building up the KBS-MEDIA (Knowledge-based Systems - Media) environment at the department of Structural engineering at Lund University. *Demonstration* systems have been and are built to

Figure 9. A work station in the KBS-MEDIA laboratory. MacII computer, B&W scanner, video camera, videodisk player, TV monitor (also displayed on the computer screen), and optical discs and audio input. CD-ROM player and removable hard disk units are not shown in the picture.

support different *applications* in the building process, for example: City Advisor, Building Maintenance (the DELPHI-project), Material and Vendor Information (AMVI), Knowledge Transfer to Building Site, and teaching tools. The KBS-MEDIA LAB at the Civil Engineering School at Lund University also carries through *basic research* concerning representation, search, and building up of knowledge. New representation forms as neural nets are tried out as well as advanced multimedia environments for simulations, analogue reasoning and virtual realities.

The KBS-MEDIA environment hosts the development of *demonstration systems* which are used to capture, test and transfer ideas among system end users in the building process and the system builders/toolmakers. We integrate *advanced software tools* and *optical media* which enables us to use different *knowledge representations* in cooperation (object oriented, decision tress, neural nets, relational databases, hypertext, analogical, calculation procedures). We define adapted *tools for problem solving* for different problem domains (decision support, information browsing and search, model building and maintenance tools, background agents, navigation palettes). Among other tools we have developed special browse tools to traverse and handle the information space for example in the form of *palettes* for browsing video images, navigational palettes, product browse palettes etc. All the time the *background agents* are there to help you. We get a more obvious and clear connection between *application* and computer stored *models* (of the applications, users and available tools). We have defined and developed tools to *access*, *collect* and *handle* very large *information volumes* in computerized models supported by real *life pictures* and *sound* as well as computer generated pictures, *drawings*, *animations* and sound. See also (Christiansson, 1989, 1990b, 1990c, 1990d).

References

Christiansson, P., (1989); "Building a City Advisor in a 'hypermedia' environment"; Journal of Environment and Planning B: Planning and Design, 1991, volume 18, (pp.39-50).

Christiansson, P., (1990a); Building Information for the future/Batir le système d´information de demain; Colloque Informatique de l'Ecole d'Architecture de Grenoble.17/18 Janvier (pp. 1-6).

Christiansson, P., (1990b), "AMVI. Advanced Material and Vendor Information System" Lund University, SE-LUTVDG/TVBK-90/3027. (pp. 1-14).

Christiansson, P., (1990c); Background Agents to Enhance Access and Growth of Loosely Coupled Models for Building Design; Preproc. 5th INTERNATIONAL CONFERENCE on SYSTEMS RESEARCH, INFORMATICS AND CYBERNETICS. (ICSRIC-90). KNOWLEDGEBASED SYSTEMS IN BUILDING DESIGN. Baden-Baden, West Germany. August 6-12, 1990.(pp 1-6).

Christiansson, P., (1990d), "Advanced Information Technology in Building Maintenance Support"; 2nd CIB W78 + W74 Seminar on Computer Integrated Construction. Tokyo. September 17-19, 1990. (pp. 1-6). (To be published by Elsevier Science Publisher).