'APPLICATIONS FOR EXPERMINTING' OR 'REASONING AGENTS' AS DESIGN DECISION SUPPORT TOOLS

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1. . The Early Design Phases of the Architectural Design Process

In this paper, we analyze the usage and impact of information technology in the early design phases of the architectural design process. Typical topics of concern in these phases are idea generation, theory formation, hypothetical reasoning, analogical reasoning, and so forth. Although these phases of the design process have been studied before, not many facts are really known about them, nor about the impact of information technology on these phases.

We therefore started an investigation of existing theories of the reasoning and decision-making processes of designers, and creative practitioners in general. This research makes diverse links with various theories in philosophy, in particular to theories that resulted from the work of Charles Sanders Peirce on the process of (scientific) inquiry (Peirce, 1958). These theories suggest that the human mind continuously cycles through three reasoning modes: abductive, deductive and inductive reasoning. The abductive reasoning mode is hereby considered as the one that produces ideas and enables interpretation; the deductive reasoning mode enables making predictions based on these interpretations; the inductive reasoning mode enables learning from experiments by refutation or confirmation. As such, we consider this interpretation of Peirce's theory a good explanatory framework for the topics of concern in the early design process.

In Pauwels et al. (2012), two main approaches were distinguished towards information system support in the early design phase: (1) applications for experimenting or making design tryouts, and (2) applications as autonomous reasoning agents. This short paper briefly outlines the feasibility of applying both approaches.

2. Applications for experimenting or autonomous reasoning agents

All three reasoning modes outlined by Peirce depend largely on background knowledge or knowledge by experience. The kind of 'knowledge' embedded

in current information systems, however, often cannot be considered anything more than static 'images' of this dynamic kind of information. If these 'images' are not updated to one's changing understanding on a regular basis, corresponding applications are rapidly 'outdated'.

Thus assuming that traditional information systems cannot replace the kind of knowledge needed for reasoning, one approach is to keep the reasoning to the human designers and let applications be additions to the physical world with which they can interact. In this case, ICT applications are essentially tools for doing experiments, based on which our human minds do the inductive and abductive reasoning. An experiment in any ICT application (modelling environment, web portal, calculation or simulation environment, visualisation framework, etc.) serves as nothing more than a new experience, similar to sketches, discussions, physical models or even complete buildings. From this experience, a new reasoning cycle of abduction, deduction and an inductive experiments starts anew.

An alternative approach suggests building autonomous reasoning agents that construct information from scratch by continuously going through the reasoning cycle by themselves. In this approach, all three reasoning modes are implemented and combined in a dynamic information system. In this setting, the information structure evolves step by step through every single observation or experiment made by the reasoning agent. By combining the diverse reasoning modes in a continuously ongoing cyclic process instead of focusing on each of these reasoning modes separately, one may be able to develop an information system that is able to make hypotheses, make predictions, devise experiments and learn, all based on the observations and experiments the system continuously goes through.

Even assuming that the theories resulting from Peirce's work provide for a good explanatory framework and that they are understood correctly, there are several barriers towards building such a system. One barrier is that the reasoning agent is required to be embedded in a physical world if it wants to learn anything of realistic 'size'. In the case of architectural design, this would require the reasoning agent to actually go through a real architectural design process by itself. Consequently, only the first approach, which relies on information systems as applications for experimenting, appears a valid strategy towards information system support for architectural design thinking.

References

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