

SUMMARY IN ENGLISH

Digital Habitats

Further development of the concept of habitat for modeling the use of information in organizations, exemplified by analyses for the design of mobile and context-sensitive systems in the healthcare sector

Master thesis in Information Studies (Informationsvidenskab)

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January 2004

This thesis is about designing work environments with elements of pervasive computing, and doing it in a way so that they support the people who work and live there. It is about *digital habitats*. The reader should be forewarned that the approach is not purely digital. My presentation focuses on *habitats* as a broader concept, which certainly does include digital systems, but many non-digital aspects are of at least equally great importance, just as in real life. Digital habitats as a method is intended to highlight aspects of human activity in a way that helps designers of mobile and context-sensitive computer systems to design systems that can live and grow with their actual surroundings. However, digital habitats cannot in any way guarantee that this will be the case, and certainly not in the present form of the method. It is meant merely as a first attempt towards an approach.

The specific purpose of the thesis is 1) to give a precise definition of and to further develop the concept of habitat as a conceptual framework for modeling the use of information in organizations, 2) to develop a simple notation for habitats, 3) to demonstrate the use of the concepts and the notation with empirical observations, and 4) to evaluate the possible contribution of digital habitats in relation to other methods used in a design process.

The background for my work is the technological advances in mobile and context-aware computing and the possibilities and challenges they present to designers of computer systems using these technologies, often referred to as *pervasive computing* or *ubiq-*

uitous computing. In Section 1.3, I give an overview of the field of pervasive computing. The methods I have used are mainly computer semiotics and activity theory. The methods are presented in Section 1.4.

In Section 2, I analyze and develop further the concept of habitat. This is the main contribution of my thesis. My starting point is the article “Habitats for the Digitally Pervasive World” by May and Kristensen (2003), where the notion of habitat is introduced. In Section 2.1, I characterize habitats as a tradition in relation to other fields. In Section 2.2, I carefully define each of the three types of habitats and their corresponding ‘dimensions’, *physical*, *informational* and *conceptual*. I do this for each habitat type by analyzing the original description given by May and Kristensen, condensing their definitions, discussing them and proposing new definitions. I do the same for *inhabitants* and *activities*. In Section 2.3, I examine how habitats are identified in the world. Again, this is done with May and Kristensen’s presentation as a background. Then follows a long analysis and discussion of the application of habitats in the three dimensions. The result is Table 2.4 describing the distinctions that can be made when using habitats. Along with the analysis in Section 2.3, I propose a simple notation to express these distinctions (summarized in Appendix A).

Section 3 consists of three examples of how the concepts and notation developed in Section 2 can be used to characterize activities supported by elements of pervasive computing. The first case (Section 3.1) is a telemedicine scenario where a paramedic in an ambulance is assisted by a doctor sitting in a hospital far away. The second case (Section 3.2) is a little more complex. I analyze activities during a workshop with school children using a system called *HyCon* for an assignment. HyCon allows information to be ‘attached’ to physical locations via GPS. The task is to walk around the city of Aarhus, finding and adding information about some topic, and to create a presentation with the results to show their classmates when they return. The third case (Section 3.3) is from a prototype of a PDA-based mobile information system, *mobileWARD*, for nurses on a gynecological-obstetrical hospital ward.

Section 4 presents a field study I conducted in an intensive care unit at Aarhus University Hospital. In Section 4.1, I outline the methodological considerations relating to the field study itself, i.e. my observational checklist (Appendix B) and other routines. In Section 4.2, I give a rather detailed presentation of the place, the people who work there, their equipment and the activities they perform. On the basis of this detailed account, in

Section 4.3, I select three activities and analyze them with respect to habitats: a morning shift, medication and cardiac arrest emergency procedures. Summing up the results from these analyses, in Section 4.4, I conclude that a habitat analysis does not provide direct solutions for design, but it does in fact show how each of the three dimensions influence on how well the activities are supported. Furthermore, the analyses have a structure that seems to make it possible to combine habitat analysis with more structured modeling methods and tools. At the same time the habitat descriptions based on the notation, in this case in combination with a floor map of the building (Appendix C), can maintain a rich representation of the model by adding further material, e.g. in the form of images. The simple graphical notation shows rather intuitively where to look for habitat candidates, i.e. where subject ‘density’ is largest. I have not had the chance to evaluate how the conceptual framework or the notation work as a means of communication between designers and between designers and users.

In Section 5, I discuss the process and the results. It is especially the insight that a habitat analysis gives into the *interplay* between activities, inhabitants and surroundings – specified in the three dimensions – that may be useful when designing mobile and context-sensitive IT support in an organization as the one I have described. The new technologies can be characterized by the fact that they must be designed with special attention to the context. Relations between system and context can be modeled quite precisely using habitats, because of the way a habitat analysis allows us to both separate and relate activities, habitats and inhabitants in the three dimensions. To the extent that I have had the opportunity to evaluate digital habitats as a method, I find that it helps focusing on interesting aspects. The notation is simple and works best when diagrams are not too complex. I have not experimented much with adding rich content but rather concentrated on the very basic representations of habitats and inhabitants. The method’s most significant shortcoming is its poor ability to represent complex models. The conceptual framework in itself, as I have defined it, can easily be used to create very complex models, but then the model must be expressed in some other form than my simple graphical elements. If one could build a robust version of the conceptual framework of digital habitats in a strong modeling language, e.g. UML, habitats would be more suited to be used as part of an effective design process. Furthermore, I find that the concept of habitat fits nicely into the Scandinavian systems design tradition. In Section 5.2, I briefly relate the healthcare sector to other domains and cautiously conclude that although I have only limited experience with the simple method I present, nothing indicates that

the concept of habitat is less useful in domains more loosely structured than the intensive care unit.

Section 6 is the conclusion with a resume of all findings in the thesis. I finish off in Section 6.1 with some suggestions for further research. I find that an interesting next step would be to integrate the concept of habitat in a model based on the UML 2.0 specifications, which could then be tested in an actual design process. In that case, one might also consider the possibility of incorporating digital agents in the model. Finally, I think it could be interesting to explore the use of habitats as a basis for rich representations of current and future systems, which may be a good way to envision future scenarios and share these between designers and between designers and users.