

The Context Gap: An Essential Challenge to  
Context-Aware Computing  
Ph.D. Dissertation  
Summary

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Context-aware computing is a recent approach to tailoring technology to the user's context. As part of the vision for ubiquitous computing, it describes computing applications that change or adapt according to environmental characteristics. Research within the field have mainly focused on technical possibilities for representing a context in the use situation, however, not many context-aware applications have made it outside the test laboratories yet. I propose that one of the problems of context-aware computing is the 'context gap,' the gap between a sensor-derived technical representation of a context, and the social perception of a context. The context gap is inevitable and inherent in that it cannot be bridged; human context can only be represented technologically to a limited extent.

In this dissertation I investigate the context gap, as it appears in context-aware computing. Other researchers have pointed to a gap between how researchers understand how the social world should be supported and what technology is capable of in relation to CSCW systems, but I address the gap as it exists in the two approaches to context-aware computing. The context gap is made visible by the new possibilities for sensor based technology and by the desire to facilitate dynamic and often mobile situations, which often introduces new challenges to interaction and interpretation for the human context.

I identify two different approaches to context-aware computing: a classic approach based on the original vision of dynamic adaption to context information and a humanistic, socially-based approach based on tailoring ubiquitous computing to the overall human context. The problems arising from such gap has been pointed to by other researchers as well, but never investigated empirically. I set out to explore not only whether the context gap exists but also what contributes to it and what consequences this might have.

To explore the gap, I conducted and analyzed three related case studies. They are each examining aspects of the context gap, adding to a better

understanding of this. Each study aims to explore one of the sides of the context gap, case study I and III looks at the use side and case study III looks at the technical side.

The first study examines the context of the users of a successful ubiquitous computing technology, mobile telephony. The case study identifies four types of context information that are important to users, and analyzes how the context gap is manifested in this situation. The second study describes an experimental setup with pre-prototype technology, investigating the context gap through three levels of interaction: personalization, passive context-aware computing and active context-aware computing. The context gap contributes to an increased sense of intrusiveness as the technology behaves more autonomously. The user's sense of control is also affected by the application's greater level of autonomy, and finally the users' sense of location privacy is seen to be one of the consequence of the context gap in context-aware computing. The third case study looks at implemented context-aware computing in a campus setting. The study explores the premises and social structures in the environment and traced the context gap from both the human and the technology side. Throughout the studies, the context gap is examined on the basis of the theoretical framework of embodied interaction.

The research contributes to both researchers and practitioners by addressing the context gap as it appears in the user situations of context-aware computing. I provide suggestions for several changes within the area. I propose a new perspective that takes characteristics from both approaches to context-aware computing. Instead of viewing context-aware computing as applications that adapt or take autonomous actions, I suggest that it should inform the users of contextual factors represented by a limited scope of context information. Secondly, I supply the first building blocks to a conceptual framework for designing and approaching context-aware computing. These components consist of a clear distinction between sensor information and context information and four general rules for design of context-aware applications. These rules suggest firstly, that users should describe their own context, secondly, that users should define the actions that the application takes; thirdly, designers should inform users of the implications of the use of specific technology and finally that context-aware applications should be reevaluated in the real environments after some time of use. I conclude by emphasizing that the context gap is found to be an inevitable challenge to context-aware computing, which needs to be addressed in order to continue the goal towards supplying users with a smooth and appropriate interaction by way of context-aware computing.