

## Towards the Emergence of a New Application Domain

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This book gives an introduction and overview of the field of Pervasive Gaming, an emerging genre in which traditional, real-world games are augmented with computing functionality, or, depending on the perspective, purely virtual computer entertainment is brought back to the real world.

We try to both inform about the developments and influential works in the field of Pervasive Games, and also help laying the foundation for shaping the future of this application domain. Consequently, we focus on concepts and theoretical works that help understanding and sharpening the rationale behind the field (the “what”) as well as on technological means of actually realizing working prototypes of Pervasive Games (the “how”).

Both perspectives have their right and need to go hand in hand. The first four of the twelve chapters contributed by leading experts in the field address the theoretical foundations. The individual authors’ views sometimes complement each other, sometimes they express similar ideas and concepts, and sometimes they even contradict each other severely. Since we are currently far from having established a common ground about what this emerging genre clearly defines and separates from related fields, we suggest treating the individual chapters with equal respect and being prepared to contribute to the field with one’s own thoughts and ideas that might help further shape and clarify the important issues of Pervasive Games.

The first chapter by Steve Hinske et al. reflects on the various approaches to define what Pervasive Games consist of, how they relate to playing and games, and how different terms and views can be integrated. The chapter contributes a unifying and integrating classification of the respective terms that relates different states of reality to the relevant dimensions and game elements.

In a similar spirit, Trond Nilsen also studies the nature of enjoyment. In his chapter, he discusses several conceptual models that help explain enjoyment, especially focusing on those with particular relevance to Pervasive Games.

An elaborated model exploring the theoretical nature of Pervasive Games is discussed by Bo Kampmann Walter. After an epigrammatic introduction to the paradigm of Pervasive Computing and its influence on the making and understanding of games followed by a classification the “four axes” of Pervasive Gaming, he discusses the particularities of game rules, game entities, and game mechanics in Pervasive Gaming.

A complementary model for understanding player enjoyment in Pervasive Gaming, the Pervasive GameFlow model, is discussed and empirically validated by Kalle Jegers with two Pervasive Game prototypes. The model's applicability in terms of how well it captures the issues of importance is validated and an expanded model is suggested.

With these theoretical contributions, the design space of the field is opened up. The following seven chapters then focus on different means to realize Pervasive Games and the issues and pitfalls that arise when practical solutions are demanded. The remaining chapters of the book are structured in terms of how they are applicable to different scales of entertainment experiences. They range from realizing the metaphor of playing with “the world as a game board” to playing with “the game board as a game board”, from supporting citywide games to entertainment on the tabletop.

As a first example for large scale approaches, Peter Kiefer et al. discuss Geogames, a class of location-based games that implement a temporal solution of coordination problems in a citywide space. Geogames are well suited for integrating edutainment content into the game flow. A learning process model is used to embed game playing in a more comprehensive learning experience.

Chris Greenhalgh and his colleagues explore the usage of mobile phones as a widely-available class of devices with supporting communications infrastructure. They discuss how a single dimension of ‘phone application type’ embodies the critical trade-off between capability and availability. They describe four different mobile phone gaming experiences that illustrate different points along this continuum (SMS, WAP/Web, J2ME/Python and native applications). As a tool for Pervasive Gaming developers they introduce a common software platform and identify four strategies for addressing mobile phone diversity.

The tangible user interfaces that connect the players and their gaming environment are regarded by Paul Holleis et al. They distinguish between a set of sensors through which users interact with a system and actuators through which the systems gives feedback to the users. With two case studies they particularly focus on new experiences due to bodily interaction and a simple way of realizing applications that build upon such a set of input and output components. They finally describe a general architecture and provide toolkit support to quickly generate prototypes as well as deployable applications.

Another approach of extending physical games into the virtual realm is discussed by Michael Rohs. The author looks at different ways to use visual marker detection on camera-equipped mobile phones for linking physical and virtual game components and for enabling spatial interaction. He shows a number of spatial interaction techniques that optically capture the movement of the device and orientation relative to a visual marker in order to enable manipulative control of mobile games. He also describes three game prototypes that integrate specific passive media - product packaging, boards, and cards - as backgrounds for handheld augmentation.

The ChairIO, a chair-based computer interface, is discussed by Steffi Beckhaus and her colleagues. This chair allows for intuitive methods to control movement in immersive virtual environments. Apart from the technical realization, a focus of the chapter lies on how to control immersive 2D and 3D games with a chair-like input device. User studies and sample games serve as proof-of-concept validation for this class of innovative Pervasive Gaming input devices.

Emerging platforms such as digital tabletops enable face-to-face social interaction with digital games. Mazalek et al. present a new sensing architecture for creating tangible media tables. The TViews architecture provides tangible interaction through real-time tracking of multiple objects on a sensing surface equipped with an embedded display. The design can generalize across diverse applications and physical contexts, ranging from home living rooms, to classrooms or public settings. They describe the technical design along with initial game prototypes for the table to show the potential of pervasive tabletop gaming.

The final two contributions of the book remain on the tabletop, but explore very different alternative means of linking the physical playing pieces on a table to the corresponding computer game applications.

Trond Nilsen focuses on Augmented Reality (AR) that is a relatively new technology in which computer generated images are made to appear as if they naturally occur in the real world. By merging the real and the virtual in this way, augmented reality offers an opportunity to draw together ideas from both tabletop and computer strategy games in order to derive new games that capitalize on the strengths of both mediums while avoiding their weaknesses. Trond Nilsen provides a practical introduction to the design and construction of Augmented

Reality games. Important practical recommendations for future designers of AR strategy games are also given to facilitate starting with this complex technology.

In contrast to the solutions in the previous chapter, Radio Frequency Identification (RFID) technology already plays a major role in many commercial application areas. In business applications, for example, the idea of smart shelves or tables equipped with RFID technology has been around for some time now. RFID tag-equipped playing pieces can also be used for Pervasive Games. A good example are miniature war games, where the current game state depends on what objects are located where, and, in some cases, how these objects are oriented. In this final chapter, Steve Hinske and Marc Langheinrich present an approach to determine the position and orientation of physical playing pieces. They introduce the conceptual idea as well as the technical realization based on the example of an augmented miniature war game.

With these twelve chapters ranging from conceptual approaches to detailed technological solutions we hope to provide stimulation and raise interest for the exciting new field of Pervasive Gaming. Many of the works presented here were initially discussed among researchers at a series of scientific symposia called PerGames that, at the time of this writing, have been held four times since 2004 and have attracted a growing number of participants each year. As a valuable next step towards diving deeper into the field, the discussion with peers and experts at gatherings such as PerGames is highly recommended. Getting active and link with other practitioners and researchers is what we hope to have stimulated with this book. The PerGames website is at [www.pergames.de](http://www.pergames.de).