

**Prototyping Pervasive Games: A New
Dimension of Complexity**

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Welcome to the second volume of the reader on Pervasive Gaming Research! With this volume we focus mainly on actual implementations and prototypes of Pervasive Games. The foundations, both in technical and conceptual terms, were laid in the first volume. Now, we apply these foundations to real Pervasive Games and explore the issues related to actually realizing such Pervasive Games. Clearly, the combination of virtual, physical, and social aspects in Pervasive Gaming contributes to a new complexity in game design, since games are no longer confined to the narrowness of a computer screen, but integrate with our real environments that consist of many things beyond our control.

When the first Pervasive Games were realized and tested, it soon became apparent that despite all the technical issues to be solved in order to make them work, the real challenges are related to the social world. The notion of “Social Adaptability” was brought up by Staffan Björk and his colleagues. This key concept describes how games and the complex social surrounding of the games get together in a way that works for both sides.

Accordingly, the first chapter of this volume by Staffan Björk and his colleagues discusses social adaptability. Through the use of several developed Pervasive Games, Pirates!, Wizard’s Apprentice, and Insectopia they describe the process of identifying the requirement of social adaptability.

With this social issue set, the remaining eleven chapters mostly present realized Pervasive Games that are ordered by their scope and size, starting from tabletop related systems and stationary installations such as a knight’s castle augmented with RFID technology until they finally span entire cities such as with the REXplorer game that helps tourists explore the history of Regensburg, Germany. Each of the discussed games has its own issues and aspects, and we hope the combination of them provides researchers and practitioners with a balanced and appropriate view of the complexities and challenges of real Pervasive Games.

Matthias Lampe and Steve Hinske discuss the Augmented Knight’s Castle which is an augmented toy environment that enriches the children’s pretend play by using background music, sound effects, verbal commentary of toys, and different forms of tactile and visual feedback in reaction to the children’s play. They also describe how interactive learning experiences can be integrated into the play (e.g.

to teach songs and poems or to provide the child with facts about the Middle Ages). Different possibilities are realized based on various mobile and pervasive computing technologies. Radio frequency identification (RFID) technology is used to automatically and unobtrusively identify toys in the playset. Mobile phones and “smart toys” equipped with sensors and RFID readers are introduced into the playset to enhance the play and to provoke further interaction.

While Lampe and Hinske focus mainly on augmented toys, the STARS platform from Magerkurth and his colleagues targets the realities of smart home environments including environmental parameters and even furniture, in order to realize immersive gaming situations. They contribute two chapters, one on a formative multi-method evaluation on future gaming systems that motivates the development of STARS and one on the platform itself.

The user study attempts to answer the question about the expectations on a future entertainment system by its potential future users. Following a scenario-driven approach, quantitative and qualitative methods are employed to elicit feedback from different target user populations. Based on the results of the different evaluation parts, a set of design requirements for future home entertainment systems is derived and implemented with the STARS platform discussed in the following chapter.

The hardware and software platform STARS is used to realize computer augmented tabletop games that unify the strengths of traditional board games and computer games. STARS game applications provide a tangible interface with physical playing pieces to facilitate natural interaction. The chapter discusses STARS in terms of the hardware setup and the software platform used to develop and play STARS games. The interaction design within STARS is discussed and sample games are presented with regard to their contributions to enhancing user experience. Finally, real-world experiences with the platform are reported.

Physical interaction is also the main focus of the next chapter by Martin Faust. Although physical affordances are exploited, many games are missing certain kinds of feedback at the interaction level. The chapter discusses aspects of feedback where physical and artificial objects are interacting. To illustrate the ideas, the work on Haptic Airkanoid is presented. Finally, the impact and application of the haptic interface is discussed and observations highlighted.

The following chapter by Adrian David Cheok and his colleagues outlines an overview of new paradigms of social and physical interaction in mixed reality entertainment. In order to regain natural interactions, they argue that mixed reality technology has great potential for promoting social and physical interactions in entertainment. In their chapter they present various research prototype systems to explain methods of natural interactions for increasing social and physical interactions in mixed reality entertainment. Some of their details, benefits, and issues regarding design support are discussed.

Daniel Wagner and Dieter Schmalstieg then apply Augmented Reality techniques to mobile interaction devices, thus leaving the well-defined boundaries of location-based Pervasive Games. Since handhelds such as mobile phones and PDAs are common today, developing games for these devices has become a huge and profitable market. In this chapter the authors discuss design aspects that are specific to the still mostly unexplored area of Augmented Reality games on handheld devices.

The chapter by Guido Heumer and his colleagues presents Paranoia Syndrome as a novel hybrid game approach. Paranoia Syndrome combines classic multiplayer strategy game elements using 2D computer graphics on PDAs with location-based interaction paradigms in physical space using RFID technology and tangible objects. The combination of virtual and physical reality interaction in addition to a rule system that encourages player cooperation, provides an innovative and powerful approach for social gaming experiences.

A similarly interesting gaming approach comes from Stephen Boyd Davis and his colleagues. Their chapter describes a unique Pervasive Game which uses both GPS and live heart-rate monitoring in a mobile device. The objectives of the game's development include a health science agenda concerned with the player's wellbeing and physical activity, reflecting increasing concern over the health consequences of modern ways of living. These issues are explained, and the technical, design and gameplay challenges in working with heart rate data are described. An arts-based approach to mapping the exploratory aspects of a game is introduced, emphasising the relationships between objective and subjective aspects of the player's experience.

The works of Florian "Floyd" Mueller are also concerned with health and fitness. He addresses the issue that in our modern, often nomadic society, people increasingly

lack the opportunity for social leisure activities, such as social gaming, although beneficial to mental and physical health. He aims to work against this trend by recreating the social experience known from existing games in a distributed environment. His approach utilizes the physicality of existing leisure games in a networked environment to support social interactions between geographically distant players. He presents four pervasive games of this concept, each with a different focus on this approach. Based on observations with these systems, it is shown that the physicality of the games facilitated by an Exertion Interface contributes to a compelling experience, which can support social interactions and connectedness between geographically distant players.

Rafael Ballagas and Steffen P. Walz then discuss REXplorer, which is a Pervasive Game set in the historic city of Regensburg. In the game, historically-based spirits are stationed at points of interest throughout the city. Players use a special “paranormal activity detector” (a device composed of a mobile phone and a GPS receiver in a protective shell) to interact with location based and site specific spirits. A novel mobile interaction mechanism of “casting a spell” (making a gesture by waving the wand-like detector through the air) allows players to awaken and communicate with spirits to receive and resolve quests. The game is designed to make learning history fun for tourists and influence their path through the city. In the chapter, the authors concentrate on describing the design process and specifically take a look at prototyping techniques used to create both low and high fidelity prototypes.

The final contribution comes from Leif Oppermann and discusses Love City, which is a text-driven and location-based multi-player game for mobile phones which connects 3 English cities via one imaginary Love City. It has been played by about a hundred players for the period of a month. The chapter describes the game from the designers’ perspective as well as from the technologists’ point of view. It also describes the communication strategy which contained elements of mass participation and allowed Love City to reach a wider audience. The chapter concludes with an evaluation of the experience.

With these twelve chapters we hope to inspire interested readers to start developing or researching Pervasive Games and to take this volume as a source of stimulation that allows following the experiences of the contributing authors. Similar to the first volume, many of the applications featured in this book were

initially discussed and improved among peers at a series of scientific symposia called PerGames. PerGames is an excellent opportunity to meet the people behind Pervasive Games and to join a growing community of future gaming innovators. Please check the website at www.pergames.de.