LEARNING, GAMING, DESIGNING:
USING PLAYFUL PARTICIPATION TO CREATE LEARNING GAMES TOGETHER WITH HIGH SCHOOL STUDENTS

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KEYWORDS

ABSTRACT

THE PAPER DEALS WITH DEVELOPING LEARNING GAMES IN THE AREA OF INFORMATICS AND SOCIETY IN AN INTERDISCIPLINARY COLLABORATION OF RESEARCHERS, UNIVERSITY STUDENTS, AND HIGH SCHOOL STUDENTS IN VIENNA, AUSTRIA. IN THIS PROJECT, WE APPLY MIXED METHODS TO ENSURE MEANINGFUL RESULTS. PLAYING RESEARCH AND GAME ANALYSIS ARE SUPPOSED TO PREPARE SECONDARY SCHOOL STUDENTS FOR THE TASK OF DESIGNING AND CREATING LEARNING GAMES IN A PARTICIPATORY SETTING, USING EXPLORATIVE DESIGN AND DESIGN THINKING. THE STUDENTS ARE SUPPORTED IN DOING SO BY THE ACADEMICS. THE RESEARCHERS WILL ALSO EVALUATE THE OUTCOMES. THE PAPER PRESENTS THE FIRST EXAMPLES OF INFORMATICS AND SOCIETY LEARNING GAMES AND USE THE FOLLOWING APPROACHES TO TRIGGER LEARNING EXPERIENCES: HUMOR AND EXAGGERATION, SHIFT OF PERSPECTIVE, THE PRESENTATION OF FACTS, AND TRIAL AND ERROR. THESE RESULTS FROM THE EARLY STAGES OF THE PROJECT ARE ENCOURAGING AND HINT AT THE POSSIBLE SUCCESS OF PLAYFUL PARTICIPATION IN THE FIELD OF GAME-BASED LEARNING.

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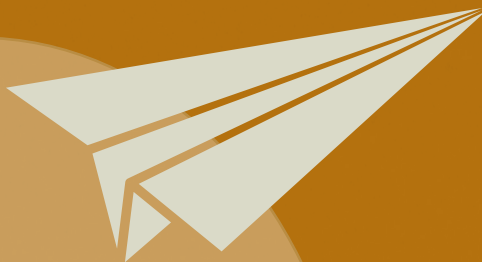
Introduction

This paper reports on the mixed research and design methods used in an interdisciplinary and transinstitutional project aimed at encouraging playful participation in game-based learning. The paper highlights the collaboration between three schools in Vienna, Austria, and illustrates how playful and collaborative approaches towards using games in class were applied in working with high school students and students of the Vienna University of Technology. We further show the results of a first round of explorative prototyping of learning games.

According to Brown and Vaughan (2009), "Play is exploration, which means that you will be going places where you haven't been before" (p. 212). What they propose is a view of games as possibility spaces that allow for exploring activities without fearing the consequences of your actions. Such safe-to-fail game environments are also important for learning and can enable children to learn about the consequences of their actions in a playful and explorative way. Kurt Squire (2006) highlights three areas of learning where game-based approaches are important: collaborative learning, learning through failure, and personalized learning. Playful and participative approaches are promising concepts to use in game-based learning.

Zimmerman (2004) distinguishes between three modes of play: formal gameplay, informal ludic activities, and playfulness, which he defines as engaging in aspects of play and fun in the context of not game-related activities. The context of this paper is a particular game-based learning research project, *Sparkling Games*[1], in which learning games are developed playfully in close collaboration between academics and high school students in Vienna, Austria.

Sparkling Games

Together with secondary school students, the project team investigates how concepts from the field of game-based learning can be used to develop learning methods and teaching materials. These methods and materials are supposed to enable the integration of the topic "informatics and society" into computer science classes as well as into other subjects, e.g. arts. The choice of topics follows the computer science curriculum and the official guidelines for media education issued by the ministry of education. Coverage of topics revolving around informatics and society in schools is explicitly intended in the respective curricula. In the ninth grade syllabus, the following specific wording is found: "The students are supposed to learn about essential measures and legal basics concerning data security, privacy and copyright as well as to understand the effects of the use of technology on individuals and the society."[2]

In fact, the societal context is often severely disregarded in schools, and the instruction mainly focuses on technical skills and competencies. In light of the constant societal change, it is becoming more and more important to deal with sociopolitical issues in classrooms in a systematical and structured way. In recent years, the spread of technical development has increased considerably. Hence, new societal areas of tension arise that are of major importance for everyday life. Questions concerning copyright and intellectual property, privacy and surveillance, social media and big data, digital vulnerability and dependency of users have quickly evolved from minor issues into central issues in sociopolitical debates. Consequently, the consideration of relevant topics in class is becoming more and more important. The project Sparkling Games addresses these issues that are difficult to integrate into instruction.

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1)   http://piglab.org/sparklinggames (last accessed Aug 3rd 2015)

2)   https://www.bmbf.gv.at/schulen/unterricht/lp/lp_neu_ahs_14_11866.pdf?4dzgm2
         (last accessed Aug 3rd 2015), translated by the authors.

The project goal is for the participating secondary school students to design learning games in the area of informatics and society. The range of created games comprise board and card games as well as computer and console games. The participating scientists support the students, observe the process, and evaluate the results. Thus, it is possible to draw conclusions about what constitutes a successful design of learning games geared to the target group. Furthermore, the project team has analyzed if and how well suited the chosen approach of designing learning games is as a teaching method. The target audience of the created games are students in grades 9 to 13. The conclusion and highlight of the project will be an exhibition of the games at the game trade show GameCity 2016 in Vienna's town hall. A discussion of the project results between the participating and other interested teachers is planned to take place at this event.

The project Sparkling Games encourages an exchange of ideas and skills between the participating secondary school students and scientists. Expertise in the areas of game design and reflection on as well as evaluation of games is imparted to the students. Also, the scientist gain valuable insights on designing learning games. In contrast to conventional research approaches, these insights are not formed by rating existing products—instead they arise directly from the target audience. We further hypothesize that the process of creating learning games constitutes a valuable learning experience in itself.

Mixed Design Methods

The work with the students starts with a detailed analysis of existing games—learning games, but also games that can be applied in the context of teaching without explicitly being learning games. All participating high school students research games and collect them in a joint online database. This step consists of playing research, which means learning about games by playing them reflectively (Aarseth, 2003) and game analysis, because the games are structured by formal criteria when being entered into the database. In the subsequent step, the students select topics in the area of informatics and society based on their research and the database. They are then supposed to initially develop concepts and later proper games or game-like materials that, according to them, help support teaching.

The academic researchers collaborate with three teachers from three different secondary schools. Each teacher will guide and supervise one class. The high school students' task will be researching learning games, identifying game elements, and then designing learning games revolving around the topics of informatics and society. In addition to the teachers, the research team will also guide the students, especially teaching them how to design games and guiding them through the research process. For this purpose, workshops are offered. In the first workshop, the students are introduced to the topics of informatics and society and are briefed on how to research games and game elements. After the first workshop, the participating students visit GameCity, the Viennese game trade show, to learn even more about games. Also, the project team provides those students who usually do not play a lot of (video) games with certain games they can try.

The second workshop specifically deals with questions of game design (using explorative design and design thinking). In two hours, the participating students are enabled to create basic designs for learning games. While the game development students from HTBLVA Spengergasse have the goal to design and implement actual video games, the students from the other two schools will design paper prototypes that might later be implemented by informatics students of the Vienna University of Technology.

Explorative design is a term coined in recent years to describe an approach where design practices are utilized to facilitate research. The concept goes back to John Dewey's *Theory of Inquiry* (Dewey, 1938), where he introduces the concept of "doing for the sake of knowing". Donald Schön built on the work of Dewey when he observed that much of the knowledge needed and used in the design process is not known a priori, but is acquired during the design process as a result of interacting with the object to be designed (Schön, 1983). This process, commonly referred to as "analysis through synthesis", is at the core of explorative design approaches. Zimmerman, Forlizzi, and Evenson introduced the notion of "Research Through Design" in 2007 (Zimmerman

et al., 2007), advocating an understanding of design practice as a relevant approach for research. Similar approaches have previously been documented by Burdick (2003) and Ehn & Löwgren (2004). Stapleton (2005) documented the use of design as research in game studies as a RADDAR method (research as design, design as research method). Explorative design has since become the term to describe the use of design as a vehicle for knowledge creation.

In Høbye & Löwgren (2012), the authors list three essential components of a process they call "research-through-explorative-design", referring to Buxton (2007) and Hallnäs et al. (2002):

1. *A focus on "sketching with technology", […] is used to explore issues of behavior and enactment (as opposed to envisionment). […]*

2. *Experimentation in the sense of making and trying out prototypes or partial prototypes is the primary mode of working. […]*

3. *The goal of the experiments is to grow an understanding and a sensibility for the experiential qualities of embodied interaction's materials and ensembles.*

(Høbye & Löwgren, 2012, p. 33)

Given the importance of player experience in digital games, it becomes quite obvious that explorative design approaches are of high value to game development. While many aspects of games can be tried out using sketches, paper prototypes, and similar low-tech means, the player experience often has to be designed in a tightly coupled loop of explorative design and evaluative inspection.

Design thinking approaches inter and transdisciplinary topics by including teams formed by people from different departments of universities, institutions, and companies. The aim of its application is to facilitate innovative solutions for complex problems through collaboration across multiple disciplines (Mateus-Berr, 2013). The process of design thinking iteratively passes through the stages of understanding, observation, empathy, ideation, prototyping, and immediate testing. Between these iterative stages feedback is an essential part.

Both explorative design and design thinking approaches are inherently playful and focus on participative and open-ended approaches.
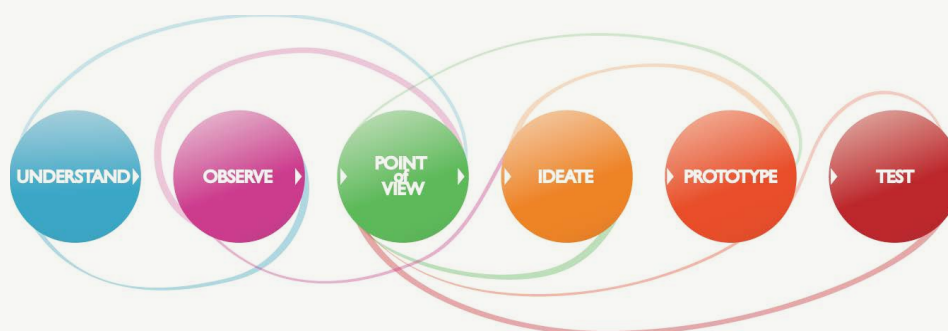

Figure 1: The iterative stages of design thinking according to Stanford University[3].

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3)   https://dschool.stanford.edu/groups/k12/wiki/17cff/ (last accessed Aug 3rd 2015)

After the secondary school students have first developed their game concepts, they meet each other to interchange ideas and profit from their different notions and approaches. The second semester of the project opens with another workshop, again addressing design questions and dealing with (newly emerged) uncertainties or doubts.

At the end of the project, the researchers organize an internal convention where, again, all students meet and present the games (or game prototypes) they have come up with. The students then review their finished creations and give structured feedback to each other. Also, the researchers evaluate each project and its outcomes with the help of the participants.

Evaluation Methods

In order to evaluate the high school students' understanding of the impact of the internet and technology on society, the project team designed an online questionnaire (pre-tested by students from the participating schools). Among the questions asked are items on and assessments of problematic internet use and practices, motives of use, as well as personal experiences with and ideas about the impact of informatics/technology on society. Questions revolve around the fields of data security, copyright, internet addiction, peer pressure, cyber crime and bullying, online advertising, as well as media literacy.

The sample size will be about 70 students in three classes and a numerically equal control group, who are not involved in the game design part of our study. After the explorative design stage, the students will once again answer the online questionnaire in order to find out what progress they made in their critical reflection on informatics and society (i.e. discrepancies and/or differences in the results of the first survey set). Also, of course, there will be a comparison of the results from the participating students with those from the control group.

A further evaluation step within our research project comprises a focus group discussion (and their documentation using mind maps) with teachers to reflect on the game design process and its results. The collected quantitative and qualitative data will be essential for the assessment of the high school students' newly acquired skills in the field of informatics and society.

Design Workshops with High School Students

In the following, we describe the first and second workshop conducted with high school students in the autumn 2015. We document and reflect on the workshops and later discuss playful aspects of the design process of learning games. The first workshop was meant as an introduction to the research project. In a participatory and playful way, the students were confronted with some basic theory behind games as well as with the topic "informatics and society". Also, they were presented with their first task: filling the project's online learning-game database. Instead of just explaining everything to them, and thereby taking the position of an expert, the workshop facilitator asked the participating students to work on content themselves in pairs and small groups. This participatory approach is meant to empower participants and support them in discovering how much they already know. The goal is to engage and empower the participating students to get creative and become involved. The workshop clearly prepared students to be active and perceive themselves as experts.

The second workshop focused on game design. We first brainstormed on elements that make a game entertaining together with the students and organized the results in a mind map. We then introduced them to the concept of a core game mechanic, which is the central action players perform in a game to reach the goal. Students split into groups of three and were randomly assigned a set of five verbs using Tiltfactor's Grow-a-Game card set[4]. We provided materials (paper, colored pencils, scissors, glue, empty cards, board game pieces, dice, etc.), and the students used them to create a paper prototype, which implemented two of the core game mechanics.

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4)   http://www.tiltfactor.org/game/grow-a-game/ (last accessed Nov 24th 2015)

After one hour, each group presented their concept to the class, and everybody was invited to give feedback. The workshop succeeded in introducing students to the basics of game design. It also served as an introduction to the playful and iterative nature of the project itself. However, some students criticized that the created games were detached from the project's general topic of learning games. They stated that they would have preferred the workshop to allow them to create a concept for a learning game rather than creating something that is not used in the project further on.

The two workshops were starting points for the design process of the learning games made by student. The process itself is meant to be play-centered and playful. When students enter games into the database, they reflect on play and its implications. The database also acts as a hub for knowledge exchange and participation. The workshops established the collaborative environment for the design process, where groups work together and design game prototypes in iterative cycles of design, play, and evaluative introspection. These cycles of design, play, and reflection were used on a small scale to structure the game design workshop. In the larger scale of the project, there will be meetings with all participating students where games or game prototypes are played and feedback is given across schools. The methods used in the workshops and for creating the games are primarily explorative design and design thinking. Both are methods that encourage learning through exploration and failure.

Explorative Design Prototypes

We followed the method of explorative design to generate first results. The method was applied with media informatics students on the seminar "Gameful Design" held at the Vienna University of Technology's Institute of Design and Assessment of Technology in early 2015. The seminar teaches game design processes through a series of actual games that are created over the course of one to three weeks each.

Students were organized in groups of two, and the timeframe for finishing a playable prototype was two weeks. They were tasked to create a playable digital prototype that deals with a topic in the area of informatics and society. The created prototypes were supposed to either convey the theoretical foundations of a topic, to raise awareness of an issue, or to trigger critical reflection. Students were also tasked to take notes of discarded ideas and to document and reflect on the design process. They were free to choose the preferred technical means and game genre.

As starting points for their design, students were referred to talks and writings by academics including Jane McGonigal (*Gaming can make a better world*[5]), Ian Bogost (*Gamification is Bullshit*[6]), and Sebastian Deterding (*Getting Gamification Right*[7]). These resources discuss gameful design approaches from different perspectives.

Overall, five different prototypes were produced. In the following, we present the consolidated insights drawn from making, playing, and discussing these prototypes. For the learning process of the seminar, creating the prototypes was as important as collaboratively playing, reflecting on the resulting games and learning from failure.

In this section, we briefly outline five prototypes of learning games created by students. For each game, we further discuss how informatics and social issues are conveyed.

REAL LIFE is a satiric competitive game to combat smartphone addiction, where you collect experience points for staying away from your smartphone (figure 2). The core principle of this game is to trigger learning through humorous exaggeration.

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5) http://www.ted.com/talks/jane_mcgonigal_gaming_can_make_a_better_world (last accessed Nov 24th 2015)

6) http://www.bogost.com/blog/gamification_is_bullshit.shtml (last accessed Nov 24th 2015)

7) https://www.youtube.com/watch?v=7ZGCPap7GkY (last accessed Nov 24th 2015)

Figure 2: A screenshot of the REAL LIFE game showing time spent on Facebook. (Reproduced with permission of the students on the seminar Gameful Design)

Surveillance Tycoon is a game where you have to make profits by selling surveillance technologies like CCTVs, spyware, etc. to governments. To maximize profit players also need to exert influence on politicians and public opinion (figure 3). The game puts players into the particular perspective of distributors of surveillance technology and also presents realistic facts regarding the perception of these technologies by the general public.
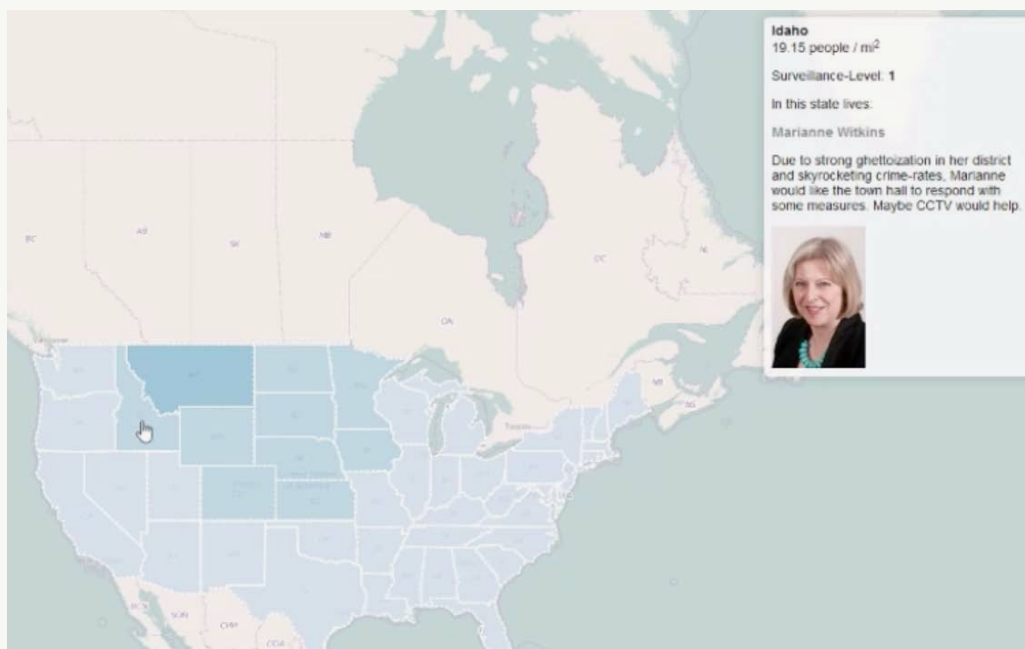

Figure 3: A screenshot of the Surveillance Tycoon game showing the interface for browsing public opinion on surveillance technology. (Reproduced with permission of the students on the seminar Gameful Design)

Wired puts players in the role of a telephone operator in the 1930s. Players use a call router and have to connect the caller to her target by wire as quickly as possible, later handling multiple calls at the same time. The game is less learning-oriented than the others but presents an interactive glimpse into the history of communication technology.

PONG It is a game about password security. The better the password a player enters in the beginning of the game, the broader her pong bat becomes, thus making the game easier to play. The game applies a straightforward approach of trying out which kinds of passwords are more secure than others.

Social Engineer puts the player into the shoes of a thief who stalks potential targets on a Facebook-like social network. By collecting information posted on the social network, players determine an ideal target, location, and timeframe for a burglary attempt (figure 4). This game again uses a shift of perspective to sensitize players to privacy on social networks.
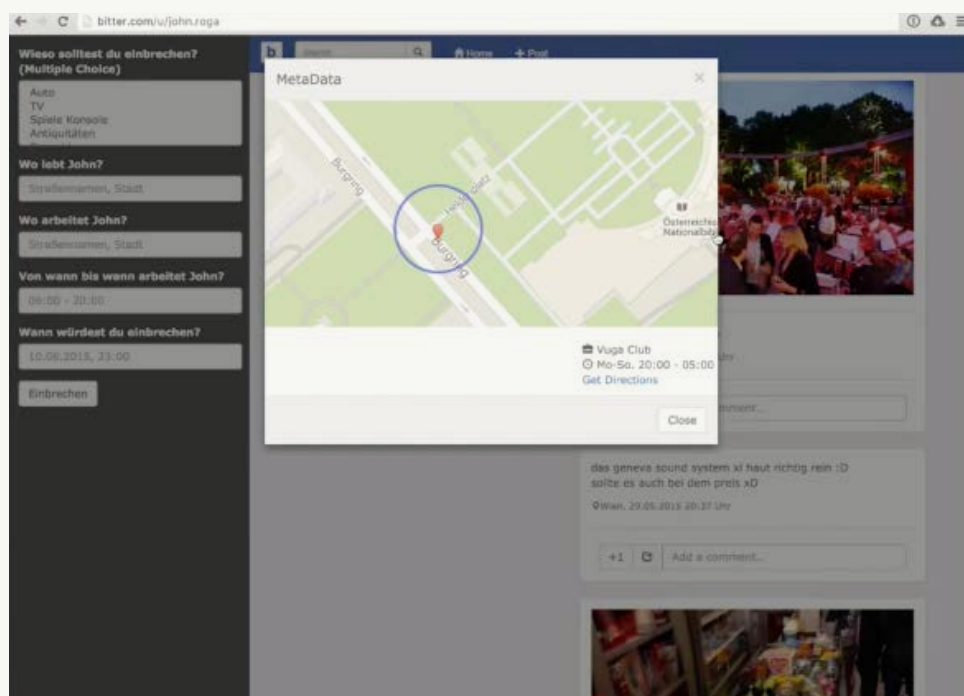

Figure 4: A screenshot showing Social Engineer's interface for collecting meta data for a burglary attempt. (Reproduced with permission of the students on the seminar Gameful Design)

Summary

In this article, we have presented the mixed design and evaluation methods to be used in the *Sparkling Games* project. The methods used to design and create learning games together with high school students are playing research, game analysis, design workshops, sketching, explorative design, and design thinking. The methods used to interpret the created games and the students' learning progress are two online surveys with a control group each and a focus group discussion with teachers.

We also discussed the first results of the presented methods: a series of five game prototypes to support learning in the area of informatics and society created using the method of explorative design. The approaches these games use to trigger learning experiences are humor and exaggeration, shift of perspective, the presentation of facts, and trial and error.

The project stage that includes the high school students began in the autumn of 2015, and the first two workshops have been held in all three participating schools. The workshops introduced students to the topic and scope of the project and established a playful mode of creating and reflecting design.

Acknowledgements

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