

Chapter 11

Urban Exergames: How Architects and Serious Gaming Researchers Collaborate on the Design of Digital Games that Make You Move

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Abstract This chapter presents a novel research collaboration between architects and computer scientists to investigate and develop mobile, context-sensitive serious games for sports and health (so-called exergames). Specifically, it describes a new approach that aims to design exergames which interact with the player's built, topographic, and social environment in a meaningful way and presents strategies on how to integrate research on health-oriented urban design and planning to the design of such games. To that end, this chapter analyzes the state of the art of mobile context-sensitive exergames and introduces the reader to the basics of "Active Street Design". After recapitulating how the built environment influences physical activity such as walking, cycling, and stair climbing in everyday situations, it is speculated on how to integrate best practices and guidelines from architecture into the game design process in order to create attractive and more effective exergames. The chapter is concluded with a discussion on strategies to validate the (positive) side-effects of urban exergames and an outline of future research directions.

11.1 Motivation

The advance of child obesity, especially in western countries, is a well-documented phenomenon [8]. As obesity is known to promote a variety of medical disorders, such as diabetes and hypertension, this trend is likely to turn into a severe problem for societies as a whole within a few years. People affected suffer from a shortened

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life expectancy and oftentimes report a generally reduced quality of life [24]. Consequently, the fight against childhood and adolescence obesity has become a major challenge for governments, medical institutes, and fitness professionals alike. It is often pointed to the various causes for obesity including an increase of calorie intake and decrease of physical activity on a population level, social environments, individual lifestyle choices and genetic disposition. James et al. [14] highlighted that genetic disposition would make a major difference in individual susceptibility to weight gain among people living in comparable environments. In their view, it is therefore obligatory to oppose the numerous prejudices and immense pressure that is put on obese children and adults' excess weight. The most appropriate response would be to consider environmental circumstances and peoples' particular needs for help. In our view, one possible route to answer this demand is to bring together the dynamic, adaptive, and personalized nature of digital applications and the highly influential—but more static—aspects of the built urban environment in order to unfold meaningful, exciting game experiences that stimulate to navigate and move through, experience, and play within the city.

Elsewhere, Knöll and colleagues have described the “spontaneous” character of such location-based and ICT-supported interventions for health [20]. In addition, it is crucial to emphasize the role of serious gaming for stimulating physical activity. One just needs to watch a group of children or adolescents play catch in a public pool during a hot summer's day or throw snowballs at each other in the freezing winter to realize the power of fun when it comes to making people move, especially those of young age. Using fun as a driving factor in order to motivate a desired behavior with intended side-effects (such as physical activity or learning) is the core idea of serious games [12]. The designers of these games combine “serious” applications, such as educational software, with game elements that are meant to enhance the user experience and to motivate users to invest additional effort into the tasks given, such as the solving of mathematical problems. The better a given serious game is designed, the more the application feels like an actual game and the less the user realizes the side-effects of “playing”, for example that she is also working on the improvement of her math skills.

An important subgroup of serious games are the so-called “exergames”, the term being a combination of the two words “exercise” and “game” [2]. These games demand the player to be physically active in order to succeed in the game, for example by running, cycling, or dancing (as determined by appropriate sensors). Media researcher Debra Lieberman observed the effects of popular exergames on players [21] and stated that “there is growing evidence that frequent exergame use helps people stay fit and manage their weight”. Mobile exergames are a variation of exergames that are not played in front of one's TV screen or computer monitor, but while being outside and on the move. They usually require a smartphone or a portable video game console to be played on. Game designer Ian Bogost already hints to the fact that exergames could interact with the player's built and social environment [3] and Knöll and Moar [18] have pointed out in more detail how different mobile exergames interact with the built environment in various ways. Elsewhere, Knöll [16] states that while urban games have been subject to research in both disciplines respectively—urban design research and computer science—few scholarship has so

far dealt with the potential synergies between urban planning and (mobile) health games in particular. The newly established research group “Urban Health Games” at the Technical University of Darmstadt, Germany, investigates health-promoting effects of the built environment in its various physical, social, and cultural dimensions and how these effects can be further researched and augmented by context-sensitive digital games. The group is established at the architecture department and is associated to Multimedia Communications Lab, where its members closely interact with the Serious Gaming group.¹

In this chapter, we will elaborate on the concept of urban health games and further specify our approach for exergames. Specifically, we will describe how architects and computer scientists, as well as game designers, health and sport experts, nutritional experts, psychologists and others should collaborate in order to design mobile exergames that interact with the player’s built environment. By utilizing the knowledge of how the urban environment affects people’s activity and movement patterns, we believe that we can build digital games that will inspire and motivate their players to explore and interact with their city. On that basis, we seek to increase the players’ general level of physical activity as such is a crucial aspect of a healthier and more satisfying lifestyle. In turn, the experiences gathered by the players should be returned to urban planning experts to assist them in their tasks of designing “active” built environments that also foster peoples’ health and wellbeing.

11.2 The Road Behind: Influences on Urban Exergames

Urban exergames are a highly interdisciplinary concept which roots in such diverse fields as architecture and urban planning, healthcare sciences, and serious games research. In this section, we will analyze the two-way relations between these scientific fields and detail their implications on the mutual intersection of all of them, of which the concept of urban exergames originates (see Fig. 11.1).

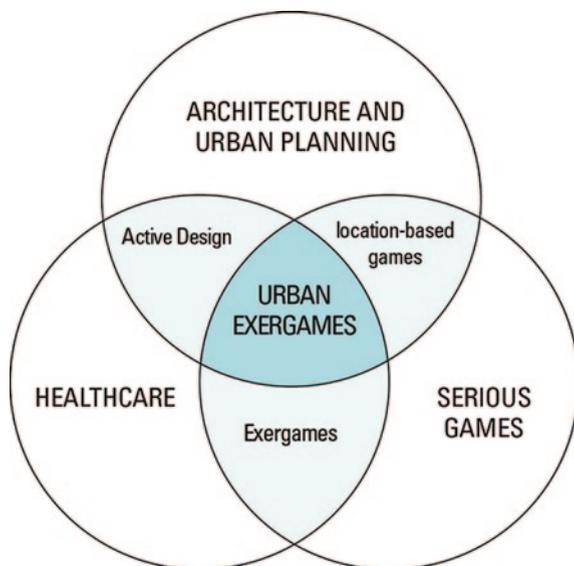
11.2.1 Mobile Exergames

When we talk about exergames, many readers may inevitably think of Nintendo’s *Wii Sports*, a set of sport simulation games such as tennis and golf, played in front of one’s TV using a wireless hand-held controller. In Mid-2013, almost 82 million copies of the game had been sold, making it the bestselling Wii console game by far and indeed, the overall bestselling video game up to date across all platforms.² This proves the existing public interest in exergames and may indicate that people are willing to invest time and money in these types of games. Of course, the observation itself does not give away as

¹ <http://www.stadtspiele.tu-darmstadt.de>

² <http://www.nintendo.co.jp/ir/en/sales/software/wii.html>

Fig. 11.1 Relevant influences to the field of “Urban Exergames”



to why people buy exergames such as *Wii Sports* in the first place. Is it based on curiosity, the desire to be entertained, or an actual ambition to work out and increase one’s fitness level? On a second thought, however, it becomes clear that this is actually not of relevance, as long as these games are designed in a way to keep the user motivated to play on a regular basis, as the intended side-effects (improved health and wellbeing) will be received in either way, regardless of the initial intentions as to why the game was bought (curiosity, fun-seeking, or fitness-striving). At this point, we will thus simply postulate that exergames are already established in the interest of a wider public audience and that there seems to be a demand for these types of games. Researching exergames, however, is a relatively new subject. We have been able to identify only a few number of research groups across the globe that focus specifically on the design and development of exergames. The groups we have found are either based in the field of healthcare and sports sciences [30] or serious gaming research [25].

A variant of exergames are mobile exergames that run on smartphones, usually played outside while the player is moving through an urban or rural environment. These games rely on the device’s built-in sensors (e.g., GPS, accelerometer) and interaction capabilities (e.g., display, microphone) to deliver the gaming experience. One such game is *Zombies, Run!* by the British company *Six to Start*.³ The game seeks to motivate joggers by involving them into an audio story that revolves around a post-apocalyptic world in which the larger part of the population has been transformed into mindless, man-eating monsters (the name giving “zombies”). The player listens to the story bits using her smartphone’s headphones while physically jogging, being addressed in person by the actors of the story as “Runner 5”. The audio story establishes the idea of a small community of “survivors” that, albeit in constant

³ <https://www.zombiesrungame.com>

danger of being attacked by the roaming zombie hordes, has managed to construct a small and relatively safe encampment. However, this group of survivors is always short on vital resources (such as food, batteries, and medicine) and so, volunteers need to leave the compound and search for these resources outside, staying on their feet in order to not fall prey to the wandering monsters. The player fulfills this task of searching for resources simply by physically jogging a certain distance while listening to the background story. Optionally, the player can also activate “zombie chases” and then needs to physically outrun a group of virtual zombies (the chase is indicated by approaching grunts and panicked “radio messages” from other “survivors”) or otherwise lose all resources collected so far. Although we can anticipate that the fictional and somewhat brutal scenario may not be for everyone, the huge success of this app, being the best-selling fitness-related application for mobile devices at one point,⁴ and its concept on how to motivate players to exercise harder makes this a very important contribution to mobile exergaming as a whole. It seems to be entertaining for many users to outrun a horde of zombies and to bring home a (virtual) backpack full of vital resources, while the training effect is secondary and nevertheless achieved. We consider this a great example of good exergame design. Additionally, the commercial success of this application proves the demand for mobile applications that make outdoor exercise “fun” and paves the way for similar approaches.

11.2.2 Location-Based Games

The concept of digital location-based games is a far more established research field, which can be traced back to at least a decade ago. In May 2000, the so-called “Selective Availability” that differentiated between civil and military users of the GPS system was disabled, resulting in a highly improved accuracy of GPS-based localization for civil users. This brought forth a variety of concepts for games that integrate the player’s physical location into the game experience, among them the still popular game of Geocaching [29]. Smartphones with their integrated GPS receivers made playing these games easy, as the user did not have to bring an additional device besides the smartphone that she was carrying with her anyway and thanks to this, location-based games were able to naturally integrate themselves into the players’ daily activities. Shortly after their emergence, more sophisticated digital location-based games like Foursquare⁵ established the concept of gaining points and achievements for physically moving to and then virtually “checking-in” at specific Points-of-Interest within one’s city, such as restaurants and shops, thus motivating players to visit certain locations more frequently and subtly modifying their movement patterns within their urban environment.

A very recent addition to the family of location-based games and a game with the potential of becoming a huge success is the game *Ingress*⁶ by *Google*. The game is

⁴ The Twitter feed of the developer studio, proclaiming the apps’ commercial success: <https://twitter.com/ZombiesRunGame/status/174164902926229504>.

⁵ <https://foursquare.com/>

⁶ <http://www.ingress.com>

currently only available for Android-based devices and even then only by “invite” (one can apply for access to the game at the game’s website). However, already today, *Ingress* is vastly popular and one can easily find many magazine reviews, blog entries, and user-made videos online that show the excitement that some players have about the game. *Ingress* is an augmented reality game in which the players have to initially decide for joining one of two competing groups (either the “Resistance” or the “Enlightened”) and then conquer virtual portals that are distributed around the world. In a nutshell, the group that holds the larger number of portals in an area dominates this specific area and “is winning”. The game makes use of various game mechanics to keep players motivated (such as player levels, virtual items, and the like), but also draws much of its allure from the fact that players are called “agents” and made believe that they belong to some sort of secret society whose members fight a secret battle unnoticed by the public. From our perspective, *Ingress* is an important game for two reasons. First, it is a location-based mixed reality game that motivates players to physically explore (and thus move through) their urban environment while hunting for portals and virtual items. Although hardly mentioned by the project designers, physical activity is a key feature of the gameplay and may therefore have positive effects on the players’ wellbeing. Second, the virtual portals are usually located at real-life statues, buildings, or works of art. By interacting with a virtual portal, the player implicitly also interacts with her built environment. Even more importantly, players can propose the establishment of new portals by taking an image of the site where the portal should be located, marking it on a map and then sending the information together with a short descriptive text to the *Ingress* development team. The game developers will then decide “within a few weeks” whether a new virtual portal will be established at this specific location. This feature gives players the opportunity to select specific elements from their urban environment and (eventually) have them integrated into the game. Through this, *Ingress* may manage to establish an emotional attachment between players and urban places. Based on these observations, we feel almost inclined to call *Ingress* a mobile exergame that interacts with its urban environment in various ways. We observe with pleasure the immense popularity that the game already seems to enjoy.

11.2.3 Active Design

In this section, we will introduce research and basic concepts of how the built environment stimulates physical activity in everyday life. Frumkin and colleagues have seen growing evidence for the fact that the physical features of “urban sprawl” discourage physical activity [10]. Frank and colleagues have observed how the three factors of transport infrastructures, land use pattern, and urban design characteristics influence peoples’ choices to walk or to cycle on the level and scale of neighborhood communities. Their analyses highlight the importance of densely-populated living areas, in which well-connected street networks prevail as opposed to “cul-de-sacs”. They also find multimodal transport networks



Fig. 11.2 Influences on urban exergaming based on Frank et al. [28, 9]

with many stops key to make people walk more in their everyday lives, e.g. commuting to work, school, or university. They emphasize the density of manifold attractive starting points and destinations for pedestrian and bicycle travel, which would result from a diverse mix of usages including housing, retail, and recreational usages, and they point to elements of street design such as sidewalks, green spaces, and lighting [9]. From an urban design perspective, their work relates to a discussion among town planners on car-friendly and “unwalkable” cities that has originated in the 1960s [11] with recent facts on potential negative effects for people’s wellbeing. Their work also provides a comprehensive overview into how the built environment in combination with public health policies and activities promotes daily movement patterns. They focus their analysis on walking and cycling as a mode of physical activities that require little or no means to engage in, short time slots, and are therefore being considered as highly accessible [9]. For us, their work raises the question if and under which circumstances we may develop exergames with similar “accessible” qualities and in which way their interaction with the urban environment differs from daily movement patterns (see Fig. 11.2).

In order to better understand how the physical environment may influence exergaming, it is crucial to emphasize in more detail how urban design influences daily

movement patterns. More recently, The New York City planning departments have provided a set of “Active Design” guidelines for architects and urban planners based on current research and best practices to stimulate physical activity. The Active Design Guidelines focus on what is in their view a highly influential factor for densely-populated cities as Manhattan, and comparable compact settings in Europe and Asia: The design of our daily environments such as green spaces, squares or cycle lanes [28]. The authors also provide guidelines on an interior level, describing effects of positioning, accessibility, and visibility of staircases within a facility, to actual design features such as stair dimensions, provision of light, colors, and using valuable finishing and materials. And although providing a compact overview on how the built environment influences everyday movement, we find that Active Design concepts need to be extended with a broader scope on how architecture influences movement, which has been articulated by many architects and most recently by Janson and Tigges [15]. Sociologists Robertson-Wilson and Giles-Corti have pointed to a general issue of such cross-sectional empirical studies, which also becomes effective in Active Design research. In their view, statistics merely showing relations between walkability and obesity may hardly resolve the Chicken and Egg-problem. For them, it appears possible that certain design features shape physical activity in its occupants. However, overweight and inactive persons could also prefer to move to areas which are car-friendly per se and that therefore suit their lifestyle of choice better. They insist on the necessity of clear evidence for any guidelines for neighborhood design, since those would provide a blueprint that will influence generations of local residents and claim for further research and improved research design in order to gain deeper scientific insights [26]. We can confirm that we would like to see more research that seeks to underline proposed relationships with more real time data such as GPS supported movement patterns and the assessment of vital parameters.

11.2.4 Other Influential Factors

The main intent of urban exergames is to motivate players to be physically active in, and to interact with their urban environment. Already this condensed summary implies that developers of urban exergames are confronted with questions such as “How to motivate players?” or “What makes a good training?” and therefore will have to collaborate with other research fields. Psychologists for example, can contribute to the development of urban exergames by helping with the conceptualization of mechanisms that adapt the game experience to the different types of players, as people are known to respond to different types of incentives, some preferring competitive and others preferring collaborative types of gameplay [1]. Psychologists are also profound in determining the emotional effects a specific environment has on a player, both “manually” through interviews and questionnaires and automatically by using sensors. Knowledge of these effects is important, as they will influence the player’s mood and thus her inclination to

keep playing (and to stay physically active). While psychologists primarily focus on determining and improving the emotional aspects of games, sport scientists are needed for their knowledge in exercise theory and their expertise in the prediction of physiological effects. Depending on the type of game (and its intended audience), the contribution of sport scientists can range from identifying game mechanic aspects that have the potential of harmful physical side effects and up to helping the game developers to create games that optimize training intensity (e.g., by developing concepts for games in which the game experience is adjusted in dependence of the user's heart rate [7]).

We conclude this section with the observation that while the main influences on urban exergames come from the fields of architecture, healthcare, and serious gaming, there are also other scientific fields that should contribute their expertise to the conceptualization of urban exergames and thus help in making them reality.

11.3 The Road Ahead: Creating Urban Exergames

In the previous section, we have introduced examples for exergames and mobile location-based games, among them the two highly popular games *Zombies, Run!* and *Ingress*. Indeed, both games can be seen as being mobile exergames, as the player is required to be physically active in order to succeed in the game. This aspect of the game mechanic is more pronounced in the game *Zombies, Run!*, in which the player needs to run a certain distance to acquire virtual items, and somewhat less obvious for *Ingress*, but the necessity of moving to specific physical locations in order to conquer the virtual portals associated to these real world places is nevertheless part of the game.⁷ Besides the fact that both games are fun to play and enjoy large player bases, we believe that they could be improved in both ways in which serious games (such as exergames) are supposed to affect the player. That is entertainment (which regards the players' inclination to play and her long-term motivation to keep playing) as well as self-improvement (which, in the case of exergames, regards the amount and the nature of physical activity involved).

Starting with *Zombies, Run!*, the game apparently is quite successful in motivating players to run just the way it is. However, since it does not integrate the player's environmental context into the game experience, we feel that it disregards a huge potential for increasing the player's immersion into the game and thus, a potential for increasing the game's entertainment factor. The game is the same regardless of the location where it is being played at, and while this allows the game to be enjoyed almost anytime and anywhere, it also makes the game feel somewhat generic and interchangeable. For instance, a comparably simple differentiation between the player running on streets, in parks, and in the woodland,

⁷ We will ignore the fact that players can intentionally bypass these sportive aspects of the games by using a car or a bus and rather trust in their voluntary compliance with the unspoken game rules.

maybe by distributing the availability of certain virtual items between these alternatives, would require players to plan and possibly dynamically adapt their running routes accordingly and so increase the player's grade of involvement into the game. Technically more challenging to implement, but also more rewarding to the player, would be the consideration of the actual physical location of the player, for example by making in-game references to nearby points-of-interest, by requiring the player to reach certain places in a given time, or by asking her to change her route in order to avoid specific "monster-infested" areas. We believe that these kinds of interactions between a game and the player's environment would have a twofold effect. First, they increase the player's immersion into the game, as they establish a bond between the virtual game and the physical world. This makes the game feel more "real" and allows it to integrate itself more naturally into the player's everyday life. Second, the player becomes more aware of her environment, for instance by having to take new running routes through the city and by having to actively look for parks and recreation areas during those exercise runs to provide for a good diversity of virtual in-game items. Creating this type of awareness for the built environment and its potentials for individual activities and their effect on one's wellbeing is one of the main intentions of urban exergaming.

The game *Ingress* is a location-based game by design. Consequently, there is a strong link between the game mechanics and the specific location where the game is being played at. We believe that the game indeed draws much of its fascination from the fact that, different to classic video games, it is being played in the public, albeit unnoticed by most. *Ingress* motivates its players to conquer virtual portals in their vicinity, and players may get emotionally attached to "their" portals which are associated to buildings or statues near their homes or working places. The fact that players can even create new portals (which are then publically available for all other players to discover and eventually conquer) further intensifies this effect of establishing an emotional bond between a person and a real-world location through the existence of a virtual game element. However, it appears to us that the game designers chose to not exploit the games' potential for also being a full-fledged exergame. While playing the game, no stimulation occurs to move quickly by foot or for regularly having to reach certain, distant locations. The game's primary intention is to entertain its players and the game designers have discovered that embedding a game's virtual world into a player's physical, real world (urban) environment provides for a high entertainment factor. In this case, the fact that the game concept also implies the necessity of a certain amount of physical activity seems to be a probably welcomed, but secondary and ultimately negligible effect.

11.3.1 What Makes an Urban Exergame

We envision the new research area of urban exergames to merge the game designs of mobile exergames like *Zombies, Run!* and of location-based games such as *Ingress* in order to create games that motivate their players to be physically active

while they explore and discover their urban environment. The Active Design guidelines, as introduced in the previous section, should be considered during the game design process in order to identify locations that motivate physical activity and thus intensify both the inclination to play and the training effect itself. Furthermore, urban exergames should provide for a way to gather feedback from their users and to pass this knowledge on and into a participatory design processes. Thus, we seek to develop urban exergames as a springboard for communication on the complex relations between health and the built environments, which in the set up of urban planning and co-design processes will help to shape urban environments that motivate and inspire city dwellers to lead healthy and active lives. Based on these considerations, we have identified the following set of criteria that a game must meet in order to be an “urban exergame”:

- Urban exergames are digital games that require **physical activity** from their players. As the term already implies, this makes them exergames, serious games that seek to motivate their players to be physically active with the intention of improving their health and wellbeing. Augmented reality approaches seem to provide for more extensive game concepts that also involve the player’s upper body into the exercises and thus go beyond the typical “run (or cycle) from A to B” tasks as encountered in many other mobile exergames.
- Urban exergames are made to be played in an **urban environment**. As most of the contributions we have reviewed suggested that the built environment plays a crucial role in the reduction of an average’s person physical activity, urban exergames are supposed to help their players in (re-)gaining the motivation for such by re-appropriating public space.
- Usually, urban exergames run as digital applications on smartphones. This **mobility** is a requirement for the creation of universal games that are not bound to a specific area, city, or country and also allows the creation of games that can be integrated smoothly into the user’s daily activities, as the smartphone is always at hand.
- Furthermore, urban exergames rely on the smartphone’s built-in sensors to perceive the current state of the user and her environment (such as “where is the user at?” or “what is she doing?”). This is a requirement for creating **context-sensitive** games that dynamically adapt the game experience to the user’s current situation and for example allow the integration of the user’s current physical location into the game experience (such as in location-based games).
- The designers of urban exergames should be aware of the **Active Design guidelines** when it comes to the selection of real-world physical locations to be integrated into the game. Knowledge of relevant guidelines helps with the identification of places that motivate people for physical activity, thus intensifying the motivation for playing and the training effects of the game. Input from urban research can be further specified according to the target group and purpose of given urban exergame projects. Burton and Mitchell, for example, have investigated how people with restrained motoric and cognitive skills navigate within public spaces [6]. What they call “inclusive urban design” may inform

exergames that are being used in training and rehabilitation projects that also thematize aspects of social inclusion and participation.

- Urban exergames should be designed to create **awareness for the built environment** and possibly inspire players to explore and discover new routes through, and new locations within their cities. Once the player base within a given city has reached a certain size, the data acquired from these player activities should be made accessible to urban planners, as it will help them to identify areas that need to be reshaped in order to create more inspiring environments.
- Finally, and most importantly, urban exergames should be **fun to play**. The designers of urban exergames should engage in and access research on popular mobile games such as *Zombies*, *Run!* and *Ingress* to learn how to create entertaining game experiences, as urban exergames will have no effect on their targeted users if no one wants to play them in the first place.

Summarizing these criteria, we can state that urban exergames are context-sensitive digital games that inspire their players to be physically active in an urban environment and that create awareness for the locations that they are being played at. Of course, even meeting all of these criteria does not necessarily provide for a “good” urban exergame which is motivating and fun to play, that induces a significant and lasting training effect, and that inspires players to explore and discover their cities anew.

11.4 Towards Urban Exergaming

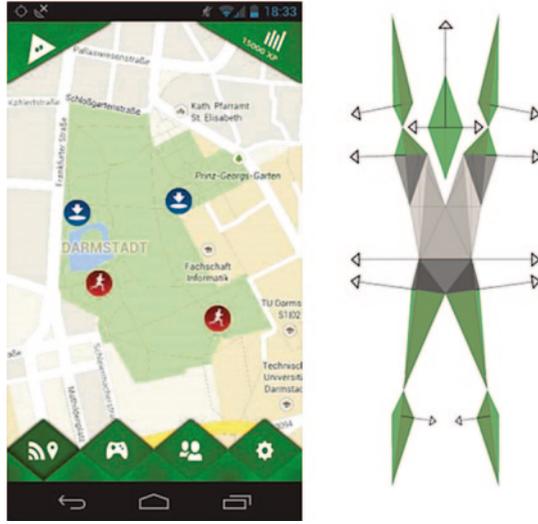
As mentioned before, the Technische Universität Darmstadt has established a research group named Urban Health Games. The group aims to better understand and influence the various potentials for digital games in health promotion and health-oriented urban planning. To that end, it develops and evaluates research projects that vary from exploration games to support navigation through recreational and touristic areas to location-based games that aim to support people affected with type-1-diabetics in documenting their data.⁸ In the remainder of this section, we would like to introduce some of the projects that we have been working on since and the first steps that we have been taking towards urban exergaming. A key task on that road, which we have outlined in detail in this article, is to develop strategies to evaluate the correlations between physical activity in the city, the playing of digital games, and their potential (positive) side effects for their users’ health. Elsewhere, we have pointed to the limited research available that validates the physiological effects of playing context-sensitive games for health regularly. Even less research focuses on the complex relationship between mobile games, a players’ health and wellbeing, and the (urban) environment in which many of these games are being played. We have specified aspects of health-oriented urban design that has been

⁸ <http://www.stadtspiele.tu-darmstadt.de>

shown to influence people's everyday activity patterns including running and cycling. In our view, "Active Design" context can also have an impact on how we play mobile games for health and demonstrates how this knowledge can be used to improve such games [20]. We are currently reviewing current strategies to evaluate effects and usability of digital applications "in the wild"—that is testing games in everyday environments as opposed to lab environments [27]. Our aim is to propose a model, which allows us to better evaluate the various effects on the player by also integrating and further structuring the information of the urban context in which exergames are being used. This model is currently being tested in our own research and design projects and will be further elaborated.

We like to conclude this article by illustrating our approach with some concepts that have been developed by students in current teaching activities both in the architecture and the computer science department at Technische Universität Darmstadt. In a seminar, we asked architecture students to develop conceptual prototypes for an exergame that would critically reflect the Active Design guidelines [17]. The results varied extensively in the way students made use of "space" in their game concepts. In one project, students would adopt the well-known Scotland Yard board game to provide a mobile hide-and-seek type of game for people with a wide range of motoric and sensoric skills. Based on Inclusive Urban Design guidelines, mentioned above, students carefully chose game locations for a location-based game with the aim to make the game experience as accessible as possible. Wide, obstacle-free and wheel-chair accessible paths were chosen and the skills to win the game aimed to balance rushing with navigating the city and site-specific knowledge. A second group worked on a different scale of the built environment by focusing on existing movement patterns that constitute a university student's mobility. Since, in their view, students are exhibiting a sedentary behavior on campus, their target was to identify movement opportunities and increase them. Their concept of a "Word Jumping" game seeks to change the way university students navigate the main building of the architecture faculty by attracting them away from elevators to the main staircase, thus increasing their movement pattern by additional stair climbing. The game is conceived to be a short distraction on the way to the cafeteria, the coffee bar, or just to a different classroom, therefore it can be played at all times, the peak being planned during the lunch break, when most students are likely to be passing in and out of the building. Having learned that the visibility of stairs, its design and finishing with attractive lightening, decorations, etc. stimulates stair climbing, the project seeks to augment the central ramp that overlooks the building's foyer with a word spelling game. The goal of the game is to create a word with the most points possible (either by being very long or by including more valuable letters). In order to achieve this goal, students have to change their sedentary pattern, access the stairs and jump. The students implemented a conceptual prototype as an installation, which featured cardboard pads, a beamer projection and an Facebook page to inform players on scores and results. Their work pointed to many ways to further develop urban exergaming concepts in different set ups and by working together with IT experts.

Fig. 11.3 The game selection screen and the Mee avatar of the GoGreen application



In a new interdisciplinary course format, we are currently developing such a new form of collaborations from a very early stage on in students' curricula. Students from three different departments (architecture, psychology, and electrical engineering/computer science) form a project team in order to contribute each own's perspective and to profit from each other's skills and expertise. Being supported by lecturers of the university's serious games lab, the sensor lab, and the architecture department, the students engage in the full process of developing a new prototype for an urban exergame and they learn important competencies typical for interdisciplinary collaborations.⁹ The first course took place during the summer term of 2013 and two teams, consisting of about eight students each, designed and developed urban health game prototypes. One of the results is called *GoGreen* and features a set of small, location-based games to be played at locations in Darmstadt, Germany. The games are connected to one another through a central game mechanic, the so-called *Mee*. The *Mee* avatar changes its appearances over time, depending on the types of activities the player primarily selects from the list of available activities. If, for example, the majority of these activities focus on running, only the *Mee's* legs grow bigger, resulting in imbalanced proportions of the avatar. Obviously, the driving idea here is to motivate players to ensure for a balanced mix of activities that involve the entire body. Figure 11.3 shows a screenshot of the game selection map (on the left) and of the *Mee* avatar (on the right).

The *GoGreen* development team invested a lot of effort into the identification of locations where the small exergames included in the application could and should be played at. To this end, they first identified all suited locations within walking distance from the central university campus to ensure that other students could play their game during lunch breaks. As a second step, they analyzed and rated those selected locations using both the Active Design guidelines and additional guidelines issued by the German *Federal Ministry of Transport, Building*

⁹ <http://www.urbanhealthgames.de>

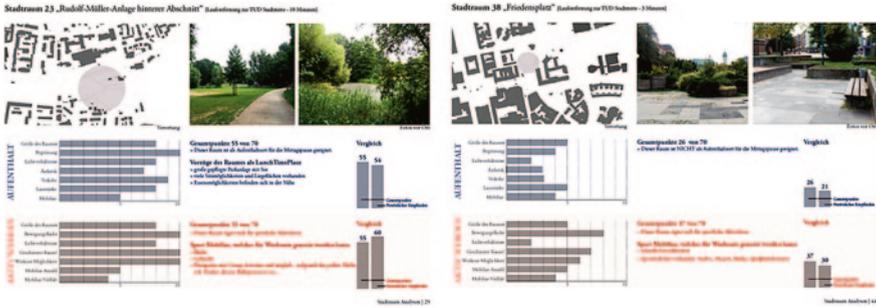


Fig. 11.4 Two site analysis reports, based on the active design guidelines

and Urban Development [5]. Figure 11.4 shows two exemplary analysis reports the group produced. Considering that the students identified and rated well over fifty different locations potentially suited for playing location-based games at, it is somewhat surprising that the games included in the *GoGreen* application itself are playable at only a single location, the so-called *Herrngarten* park in Darmstadt, Germany which can be explained by the limited amount of time available to the students during the term—and by the fact that the computer science students of the group had started implementing the game before the architecture students had finished their survey. This is a vivid example for the communication difficulties that can arise in interdisciplinary teams, and the need for fostering the mutual attunement in such.

11.5 Discussion and Outlook

In this chapter, we have introduced our vision for the emerging research topic of urban exergaming and investigated how urban exergaming differentiates from related areas of mobile gaming such as mobile exergaming and location-based gaming. As urban exergaming is a relatively new addition to the field, the identification of open questions that require further research is not a difficult task.

Certainly, one of the main challenges that we ought to address is to streamline and accelerate the process of how to select the real-world locations where urban exergames should be played at, as these places should meet the Active Design guidelines and must thus be selected thoughtfully. This translates to the question of how to create urban exergames that are not limited to a certain city district or city, but that can also be played in other cities. Games that require a large amount of work and dedication in order to be adapted to other places are unlikely to ever reach a larger audience and as such, they will not make a significant contribution to the fight against obesity in western countries. Consequently, we require an approach that enables game designers to develop urban exergames that adapt themselves automatically, or at least semi-automatically, to the player’s individual

environment. Various approaches such as a community-based selection process as used for *Ingress* are possible and need to be investigated.

Our medium-term plans for urban exergames include the supervision of multiple interdisciplinary student theses that investigate the design, implementation, and evaluation of different types of urban exergames. Through this, we hope to be able to identify a process that, when followed, helps game designers to create “good” urban exergames, games that are fun to play, that have a significant training effect, and that create an awareness for the built environments they are being played in. On the long-term, we hope that urban exergames will be able to establish themselves as a new type of mobile exergaming that helps to improve people’s lives, as the games interact with their daily activities and inspire them to be physically active in their urban environments.

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