STADTFLUCHT

Learning about Healthy Places with a Location-Based Game

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ZUSAMMENFASSUNG

Das ortsbezogene Smartphone-Spiel *Stadtflucht* ist ein explorativer Prototyp, konzipiert als Forschungswerkzeug, um die Wahr-nehmung von Stadträumen zu analysieren. Unsere Forschung über Spielerfahrungen in Stadträumen zielt darauf ab, aktive Erholung zu fördern, die Bemessung von Nutzer-Raumwahrnehmung zu erleichtern und ihre Beteiligung an Stadtplanungsprozessen zu fördern. Dieser Beitrag untersucht, wie der Prototyp Teilnehmer-Innen einer Studie in Frankfurt am Main auf spielerische Weise eine Auseinandersetzung mit der gebauten Umwelt ermöglichte. Zunächst stellen wir ortsbezogene Spiele als geeignete Forschungs-werkzeuge vor, die diese Form der Auseinandersetzung mit gesundheitsförderndem Städtebau unterstützen. Wir präsentieren dann den theoretischen Rahmen für die Nutzung von Smartphone-Technologien zur Aufzeichnung von Verhaltensdaten und Messung von physiologischen Reaktionen, die in dem Prototyp verwendet wurden. Wir skizzieren eine Reihe von Aufgaben, die die Interaktion mit der gebauten Umwelt unterstützen, und schließen mit Beobachtungen und Vorschlägen für mögliche zukünftige Forschung ab.

ABSTRACT

The location-based smartphone game *Stadtflucht* (German for *urban flight* or *city escape*) is an explorative prototype conceived as a research tool to analyze the perception of urban space. Our overall research on game experiences aims to foster active recreation in urban environments, facilitate the assessment of users' perception, and encourage their participation in urban planning processes. This article assesses how the prototype was able to engage participants in a playful manner with the built environment in a study in Frankfurt am Main, Germany. First, we introduce location-based games as a suitable research tool to achieve this type of playful interaction. We then present the theoretical frame-work for the use of smartphone technology to record behavioral data and measurements of physiological reactions used in the prototype. Finally, we outline a set of tasks that support interaction with the built environment and conclude with observations and suggestions for future research.

1. INTRODUCTION

Location-based games, as described by Avouris and Yiannoutsou, are games facilitated by mobile devices in such a way that the game activity evolves according to the players' location. The authors write: »Inherent in these games is the fact that some activity takes place in physical space« and, »[a]t the same time, some other part of the action takes place in virtual space.«[1] They argue that mobile location-based games interleave physical and virtual spaces in order to support the creation of a game space where the game takes place. The authors further suggest that although the game space would be strongly supported by the two interconnected physical and virtual spaces, it would be mostly created and supported in the player's mind. This recalls Huizinga's definition of the »magic circle«[2] in games, which Salen and Zimmerman later extended and modified for games supported by digital media. Salen and Zimmerman define the magic circle as »the idea of a special place in time and space created by a game.«[3]

In the following, we present a location-based game conceived as a research tool to expand the analysis of urban spaces through new media technologies. We will argue that the created game space, a combination of physical elements and choreographed (game) activities, is a suitable experimental setup to study users' perceptions of real-world urban environments.

We present our theoretical framework in section 2, followed by the research questions in section 3. In section 4, we will focus on one specific station in the game in order to highlight the potential of the conceptual framework developed for *Stadtflucht* to raise awareness about healthy places. Here, we discuss users' inter-actions in the featured game station as well as environmental characteristics in relation to the task and its outcomes. The evaluation is based on participants' statements of their game experience. We present the results of the evaluation of the proto-type, under specific discrete aspects, in section 5 and will end with concluding remarks in section 6.

2. THEORETICAL FRAMEWORK

2.1 THE HYBRID SPACE

Telecommunications and new media technologies allow us to adjust and almost instantaneously transcend space and time barriers,[4] placing these technologies among the most significant determinants of contemporary society. These technologies influence our understanding, experience, and production of the urban environment. Graham describes the contemporary city as an »amalgam« of urban

1 Avouris/Yiannoutsou: »A Review,« 2120-2121.

2 Huizinga: *Homo Ludens*, 10.

3 Salen/Zimmerman: *Rules of Play*, 95.

4 Graham/Marvin: *Telecommunications and the City*.

places and electronic spaces, »whereby the fixed, tangible and visible aspects of life in urban places interact continuously with the intangible, electronically-mediated transactions, operating across wider and wider scales.«[5]

Increasingly, geographical locations are being tied to digital spaces. The built environment, with its physical infrastructure, social interactions, and diverse local cultures and identities, is not only being overlaid with electronic communication-, information-, and observation networks; these technologies are becoming inseparable from the city's material form, social patterns, and experiences, making them dominant features of urban life.[6] Graham and Marvin advocate an understanding of this interaction in a non-linear cause and effect manner: Technologies, their users, and cities influence each other, producing and shaping space and structure. De Souza e Silva names the connection between physical and digital spaces supported by mobile technologies »hybrid spaces.«[7]

As a consequence, new opportunities for researchers focusing on the urban environment arise. Not only do these technologies allow researchers to gather data about the city and its users – such as the collection of behavioral data, which is linked to space and time[8] – but they also allow researchers to create a hybrid space corresponding to specific research questions.

2.2 URBAN AND LOCATION-BASED GAMES

Borries et al. argue that urban games can be a crucial element in the relationship between cities and human beings[9]; a game experience could modify the link between the city and its inhabitants, making it richer, more interesting, and more involving. Walz expands on this notion by awarding games the ability to engage users in a specific behavior within a specific context thanks to their playful and entertaining properties.[10] We understand location-based games in particular as suitable tools to do so. Advanced location-sensing capabilities, such as satellite positioning, effective sensor technology, large amounts of memory, and fast processors, make smartphones an attractive platform for the development of location-based games. The use of the context awareness of the device to guide participants through physical space and facilitate interactions with it through existing technologies is a potential for the recording of useful geospatio-temporal data for intense analysis.

In recent years, location-based games have found the most diverse applications revolving around and concerning the city. Some are being used as

5 Graham: »Telecommunications and the Future Cities,« 27.

6 De Lange: *Moving Circles*.

7 De Souza e Silva: »From Cyber to Hybrid,« 262.

8 See Girardin et al.: »Digital Footprinting«; Schlieder/Matyas: »Photographing a City.«

9 Borries/Walz/Böttger: *Space Time Play*.

10 Walz: »Toward a Ludic Architecture.«

tools to foster city exploration[11] or tourism,[12] and others are simply produced for entertainment.[13] An additional purpose of these games can be educational. Avouris and Yiannoutsou reviewed specifically location-based games for learning across physical and virtual spaces.[14] Some of the identified main objectives meant to support orientation of new university students[15] or encourage social interaction and physical activity.[16]

Tóth and Poplin have developed various games that aim to involve children and teach them about the built environment, urban planning, and participation processes.[17] These games are conceived as giant board games or are desktop-based; the interaction with the built environment is metaphorical. While these approaches have been fruitful, the question of how to create an engaging game space to raise awareness about urban characteristics and gain data on perception in real-world urban environments with a group of people remains open.

2.3 URBAN DESIGN, RECREATION, AND HEALTHY PLACES

How people interact in and perceive their environment is a vast research area. In an urban context, citizens' experiences and behavior will vary depending on the setting, i.e., its morphology and environmental characteristics. The way the elements of the built environment are configured, formed, and transformed is referred to as morphology. The urban morphology describes the formal and spatial dimensions of the urban environment (metropolitan areas, cities, and towns). The way urban morphology affects human behavior translates to e.g. the type of activities urban spaces allow or discourage. Previous research has shown that the built environment influences its users' behavior in many ways. Some of the related questions have been: How does the built environment influence the way people *move*, as in the theory of natural movement?[18] How do they *feel* in a certain context, e.g. the *emotions* evoked by it?[19] And which environmental and spatial parameters do they experience as *stressful* or *relaxing*?[20]

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11 See the Dérive app: http://deriveapp.com.

12 See Ballagas et al.: »REXplorer.«

13 See Benford et al.: »Uncle Roy All Around You.«

14 Avouris/Yiannoutsou: »A Review.«

15 See Schwabe et al.: »Mobile Learning«; Göth et al.: »Requierements for Mobile Learning Games.«

16 See Verhaegh et al.: »On the Design of Camelot«; Soute et al.: »Head Up Games.«

17 See Poplin: »Playful Public Participation«; Tóth/Poplin: »Pop-up Pest«; Tóth/Poplin: »ParticiPécs.«

18 Hillier et al.: »Natural Movement.«

19 Kuliga et al.: »Aesthetic and Emotional Appraisal of the Seattle Public Library and Its Relation to Spatial Configuration.«

20 Knöll et al.: »Using Space Syntax to Analyze Stress Perception in Open Public Space.«

To leverage healthy activities, the built environment must be designed in such a manner that it invites people to become active in various ways.[21] By inviting people to walk, climb the stairs, or relax, urban design can have positive effects on health and well-being. A playground can afford activities like swinging, jumping, and climbing; a bicycle path facilitates bicycle riding. Physical activities carried out as leisure are understood as »active recreation.«[22] In past decades, many urban planners and city stakeholders awarded active properties to the most various spaces without them necessarily being *recreational* in the formal context of land use laws. Recreationafl contexts are discrete places, as understood by the modernist idea of the division of land use in cities, like parks, playgrounds, sports facilities, and so on, where recreation takes place. This means that any space in the city has the potential to be recreational and foster active recreation.

Cohen and Evans examine »how the concept of stress has been used to specify environmental characteristics that may lead to physical or psychological discomfort and, in some cases, ill health.«[23] The authors refer to such factors as environmental stressors: physical characteristics of the environment that produce stress. A setting is thought to be healthy the fewer stressors it possesses. Knöll and colleagues have shown that people do perceive established factors of environmental stress, such as noise, high exposure to motorized traffic, and lack of green space, as *maximal stressful* when using public space as pedestrians.[24] In interviews, local residents largely agreed in their assessment of familiar public spaces from which specific *stress profiles* of locations can be drawn.

Generally, planning will aim to reduce environmental stressors to promote healthier public spaces that encourage social interaction as well as physical and sportive activities. However, in order to develop site-specific solutions and also moderate conflicting interests in the planning process, it is necessary to enable users to articulate detailed health promoting effects and gain data in high spatial resolution. One way of doing so could be to enhance health literacy. Health literacy is people's ability to read and understand basic health-related information; new tools to improve one's literacy can be acquired. This concept was introduced in the *Ottawa Charter for Health Promotion*[25] in 1986 and has been supported by the World Health Organization (WHO) and the European Union until today. High health literacy not only entails a better understanding of health-related information but a clearer articulation of the strengths and shortcomings of urban spaces.

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21 Gehl: *Cities or People*.

22 City of New York: *Active Design Guidelines*.

23 Evans/Cohen: »Environmental Stress,« 571.

24 Knöll, Martin et al. »Einflussfaktoren der gebauten Umwelt auf wahrgenommene Aufenthaltsqualität bei der Nutzung städtischer Räume.«

25 WHO: *Ottawa Chater*.

2.4 SPATIAL PERCEPTION AND COGNITION

Spatial perception encompasses the ability to sense spatial properies, such as size, distance, shape, separation and connection, or orientation of the objects, among others. The knowledge and beliefs about space and the acquisition, storage and retrieval, manipulation, and use of this knowledge[26] is referred to and specified as spatial cognition. This is the integration and processing of the perceived spatial properties into knowledge about space. We will review the topics within spatial perception and cognition relevant to the case study – navigation and orientation – along with the behavioral measures used to study each one of them.

Navigation is the ability to travel through space in a coordinated manner to reach a goal. As Basso explains:

> Spatial navigation is a particular process because it produces an exploration of the environment, that is, a series of motor actions coordinated at a high cognitive level and aimed at performing other actions: collecting information, visiting other places, performing tasks, etc.[27]

According to Montello, navigation consists of two components: locomotion and wayfinding. Locomotion refers to the movement through space, based not on prior knowledge of it but on local sensorimotor information, e.g. being able to avoid obstacles and moving toward visible landmarks. Landmarks, as indicated by Lynch, are particularly distinctive objects from the built environment, such as buildings, towers, or signs.[28] Wayfinding refers to the planning and decision making that allows an agent to reach a destination that is not immediately available to the sensorimotor system, such as when choosing efficient routes, orienting oneself by reference to nonlocal features, and interpreting route directions, e.g. finding one's way to an unknown location in a new city.

Orientation, Montello maintains, is key to the aim of reaching a destination while navigating: knowing *where you are*. The precision and comprehensiveness of this *knowing* varies according to different situations and for different people. Two types of processes are involved in orientation during navigation. The first, and relevant one to this study, involves recognizing external features or landmarks that may serve as a key to knowledge of spatial relationships: The reference point is the built environment. This is called piloting. The second is based on the integration of information about movement, direction, and/or acceleration, without reference to recognized features of the built environment. This is called dead reckoning or path integration.

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26 Montello: »Spatial Cognition.«

27 Basso: »Spatial Navigation,« 227.

28 Lynch: *The Image of the City*.

2.5 STADTFLUCHT'S CONCEPTUAL FRAMEWORK

Spaces with the above-mentioned stressors are often uninviting to citizens. The *urban flight* taking place in the game is triggered by the need to escape or learn to cope with urban stressors. An explicit objective of *Stadtflucht* is to foster as much interaction with the built environment as possible. The implicit outcome of the interaction is to learn about the featured spaces, specifically about their potential to promote health and well-being to the users. In order to learn about urban morphology and its influence on health, the game must be able to include information about the built environment, on the one hand, and health-related data, on the other. Information about health was delivered, for example, through the measurement and visualization of participants' bio signals, which could point toward stressful or relaxing effects of the settings and the given tasks. In order to include information about the built environment, researchers analyzed the chosen area with a special focus on whether the built environment could potentially foster physical activation and relaxing activities.

The conceived prototype is based on the results of a preliminary spatial analysis of the urban context, during which the researchers observed and assessed spatial and environmental characteristics. As a result, settings featured in *Stadtflucht* were categorized into two types: stressful and relaxing. Subsequently, tasks searching to potentiate or counterbalance the given characteristics of the built environment were assigned to the settings in order to augment active recreation. This was done by supporting the positive aspects of physical spaces by overlaying a virtual space, which aims to encourage physical activity, social interaction, and recovery. The use of a smartphone game allowed the conceptual creation of a new layer of information: the game space. In this »hybrid space,« participants have the opportunity to navigate and explore the urban context in a playful manner.

In *Stadtflucht*, researchers emphasized piloting through the game design and chose to record the path taken by a person in physical space. The first was done by offering participants support through the game interface so as to achieve wayfinding and piloting. This support occurred in the form of 2D maps showing the route to take (fig. 3) and presenting participants with landmarks that facilitated orientation. To record the chosen path, participants' movements were tracked with the device's GPS sensor.

3. RESEARCH QUESTIONS

Stadtflucht is a treasure hunt with a scripted and linear game play. It is structured as a route, along which six stations, each prompting different activities, are located. In the following, we will present one of the stations and explore its outcomes based on three research questions:

1. How can we design a game feature that invites users to experience potentially healthy environments as part of a location-based game?
2. Do participants engage in such a feature, and what are the levels of acceptance?
3. Which lessons may be learned from testing a prototype?

4. METHOD AND DESCRIPTION OF THE CASE STUDY

4.1 URBAN CONTEXT

Stadtflucht is custom-made for Frankfurt's neighborhood Ostend, an area undergoing an urban planning change. The neighborhood is developing toward an attractive mix of residential, cultural, commercial, and open space areas next to the river Main. The change is tightly paired with the influx of jobs brought upon by the new headquarters of the European Central Bank (ECB).
The chosen area is mainly of industrial use, very much influenced by the harbor located on the south side. It is dominated by commercial spaces and offices, with little residential housing and only some spaces for culture and leisure. Aside from the changes taking place because of the ECB's new headquarters being built on the southwestern side, the area offers different urban qualities. Our motivation was to feature some of the interesting existing spaces and offer citizens a different view of the changing neighborhood. Since the Ostend is not a tourist destination, it was very important to offer an experience that would be attractive and easygoing but would still raise awareness for the activating qualities of the environment. Some of the spaces featured of the setting are: a renewed open space, industrial buildings – some refurbished and repurposed, others still in industrial use –, main streets with high traffic volume, and quiet but lively inner courtyards.

4.2 THE GAME

The story of the game was embedded in a series of urban artistic events titled *evakuieren*, planed by the Mousonturm in coproduction with Port B and other regional partners of the Rhine-Main region. The event, conceived and curated by Japanese theater maker and urban intervention artist Akira Takayama, aimed to reveal unfamiliar spots in the urban territory of the Rhine-Main region and lend

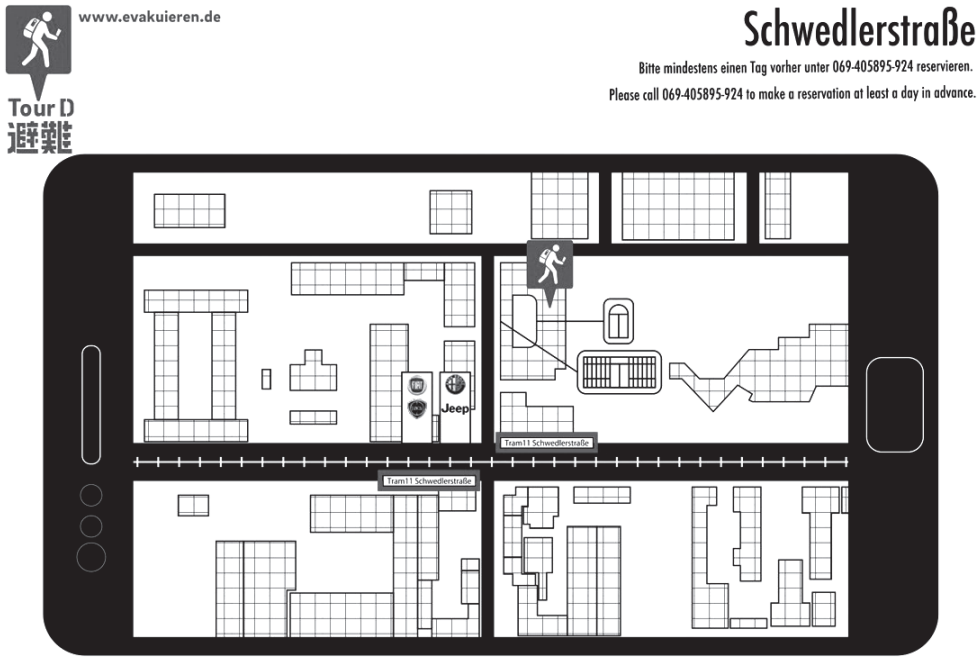


Fig. 1. Map with the station Schwedlerstraße (here highlighted in red) and the starting point (in blue). Picture courtesy of Fumiko Toda.

new meaning to the term evacuation. The project was an adaptation of the *The Complete Manual of Evacuation*,[29] first developed and released in 2010 as part of the Festival/Tokyo, an annual performing arts event that takes place in the city of Tokyo. *Stadflucht*, originally born from previous research activities of the Urban Health Games research group,[30] was well fitted to the event.

Via a simple and short online questionnaire, visitors could ascertain their personal degree of everyday frustration and urban fatigue. A customized escape route was then distributed. The route depicted only the starting point »for a journey with unexpected encounters on unknown paths.«[31] Participants were guided to stations of the local transport association RMV to later reach the places where different activities, such as theatrical ready-mades, artistic interventions, and urban games, awaited them.

The escape route given to participants for *Stadtflucht* provided them with instructions of how to get to the station *Schwedlerstraße* and indications to the starting point (fig. 1). No further information was supplied. Once they arrived at the marked spot, they were informed by the researchers about the goal of the game

29 http://www.hinan-manual.com.

30 Knöll et al.: »Urban Exergames«; Knöll et al.: »Einflussfaktoren der gebauten Umwelt.«

31 http://blog.evakuieren.de.

– to »escape« from stressors through relaxation, physical activity, and exploration. A first survey was filled out; participants received a smartphone and were brought to the starting point of the route.

During the game, the area was transformed into a game space. The virtual space – contained and expressed through the mobile device – supported the game narration in the following three aspects:

1. guide participants through the game board (i.e., the built environment): navigation,
2. announce and explain the game tasks, and
3. give participants visual feedback of their reactions to the carried out task.

The game started in front of the entrance of ATELIERFRANKFURT, where participants signed in to get a smartphone with the android application and filled out the first part of the survey. The user interface guided participants through a 30-minute circuit (about 900 m), engaging them in different challenges and getting them into contact, often unaware, with the different environmental characteristics that were investigated. The six different stations are located along the route and are not visible from the beginning to encourage exploration (for example in fig. 3). Figure 2 presents the route overview with the six stations. Stations with green bubbles feature relaxation and concentration tasks; tasks allocated to blue bubble stations intended to draw attention to certain aspects of the built environment and engage participants in contemplation/inspection; red ones featured physically activating tasks.

Each participant had to reach the six stations and complete the tasks featured in them. Each task served a different purpose and was located in an environment that supported the activity. Participants were guided and instructed through a direct imperative narrative, which supplied textual information about the route and described the tasks at each station. The goal of the game was to complete the tasks on each one of the six stations.

While moving from one station to another, data about navigation and time (GPS coordinates with time-stamp), bio data (heart rate measured with the help of the smartphone camera), and perception (photographs) were collected. After completing the task in station 6, participants were guided back to the starting point, where they delivered qualitative ratings of the area, i.e., their perception of the spaces. We will review the first station, which was located next to the harbor basin and featured a relaxation task.

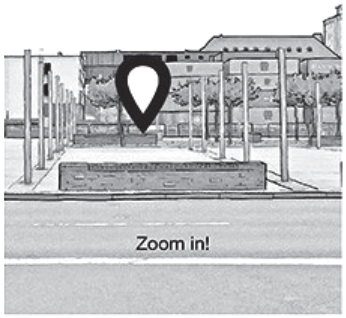
Fig. 2. Route overview: stations (1) Harbor basin, (2) Loading dock, (3) Lindleystraße, (4) Inner courtyard – spiral staircase, (5) Alley, (6) Hanauer Landstraße. Yellow play button: starting point of the route.

4.3 STATION 1: HARBOR BASIN

The first task took place at a recently renewed open square, characterized by greenery and sufficient seating options and located between the Lindleystraße and the waterfront.

Our preliminary analysis emphasized visibility, proximity to water, availability of seating and greenery, lack of transit, and low levels of noise. This was classified as a relaxing setting, and the given task consisted in relaxing.

The first step was searching for a quiet place to sit. To include information about the built environment into the gameplay, we chose landmarks that supported navigation. Navigation was provided by the means of a first look at the map with a section of the route (fig. 3) and the attendant depiction of the aimed destination (fig. 4). This was followed by the introduction to the task (fig. 5).



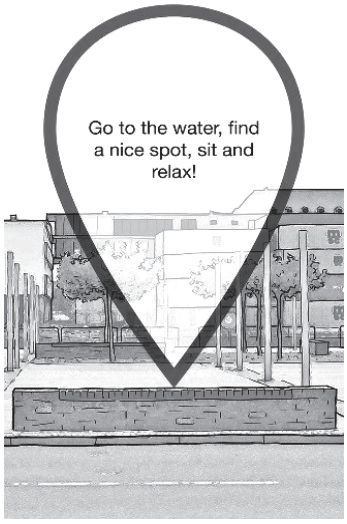
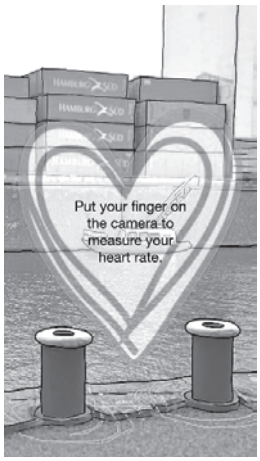
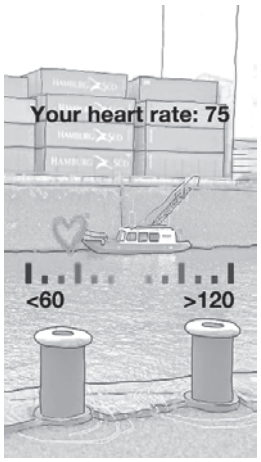
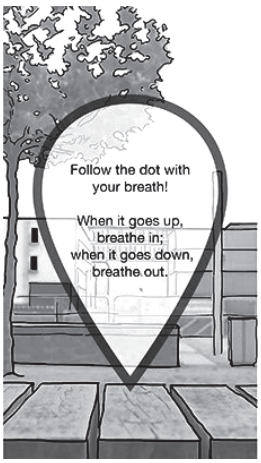


Fig. 3; 4; 5. Screens of the Android App.

Once seated, participants were asked to measure their heart rates with help of the smartphone camera (fig. 6). The application asked them to place their index finger on the smartphone camera, from which it calculated the skin color and visualized the player's pulse, giving an immediate visual feedback about the effects (fig. 7). Afterwards, participants conducted a breathing exercise as explained in figure 8. Participants pursued a relaxed and deep respiration for the duration of one minute with the help of a dot bouncing up and down at a certain speed (fig. 9). This was followed by a second heart rate measurement and feedback.







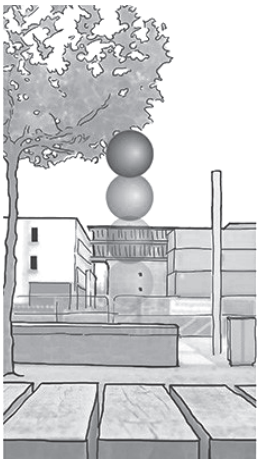


Fig. 6; 7; 8; 9. Screens of the Android App.

The question concerning urban design in this station is whether it fulfills its intent as recreational open space. Positive effects of water bodies on human behavior have been reported.[32] Bio data recorded could deliver evidence about users' physical state, before and after effects of the exercise, and be paired with users' statements about their rating as stressful or relaxing. In a further step, participants could relate their experience to the urban context while filling out the second survey on their perception of the area.

Fig. 10; 11. Participant carrying out the breathing exercise; participants contemplating the harbor.

5. RESULTS/OUTCOMES

The game was tested by the public, n=42, on-site on two consecutive Saturdays. Participants were recruited via the online questionnaire provided by Mousonturm, an online advertisement on the university's webpage, and by approaching passersby. All 42 participants completed the six stations and delivered positive feedback about the game. The game gained high acceptance throughout the different user groups. Within the limited data of this small study, *Stadtflucht* attracted a considerably high number of female participants (61,9 %). Despite reported hiccups, it proved to be fit for users of a wide spectrum of ages.[33]

In addition to the development of orientation and exploration skills and social interaction, *Stadtflucht* aims to raise awareness about the participants' reaction to environmental stimuli, e.g. participants' heart rate in a specific spot before and after the given task. Participants saw the immediate visual feedback as a nice feature, but the technical execution received criticism: The smart-phone camera would overheat after an extended period of time. This reflects on the gathered data: Participants would cancel the measurement because of the technical mishap

32 See Giles-Corti et al.: »Increasing Walking«; Watts et al.: »Predicting Perceived Tranquility.«

33 Knöll: »Bewertung von Aufenthaltsqualität.«

or the finger was not placed correctly over the camera, rendering recorded measurements unreliable for further analysis.

For the presented station, navigation tracking was of particular interest, since the apriori hypothesis was that participants would choose to move through, toward, and stay at areas with high visibility, which are spacious and bright, with enough seating available, well maintained, and with low traffic. Participants were free to decide how and where to move to, and for how long they wanted to stay there. And they did. The mean time spent in other stations was 125 seconds, while the mean time spent on the harbor was 580 seconds. This has to do with the chosen activities for the other stations and the affordance of each physical context: All other stations where *pass-through* places, and the given tasks encouraged rather fast physical activity. Nevertheless, the proposed activity in the harbor could have easily been concluded in about 120-160 seconds. Users recalled staying in the harbor contemplating and enjoying the unexpectedly relaxing spot long after finishing the task.

The evaluation concentrated on demonstrating the feasibility of such an approach for research purposes, rather than on the evaluation of the tasks in particular. After evaluation, we observed the unfolding of an open discussion about specific features perceived in the urban spaces as part of the game experience. Through participants' statements, we were able to conclude that:

- users enjoyed engaging in and with the context;
- users enjoyed the different tasks;
- users familiar with the environment mentioned that they recognized new locations and architectural features of which they had not been aware before;
- users returned more aware about the built environment but not of their bodily reactions to certain tasks;
- a wide range of age groups participated;
- an all-around experience is important: A game may not stand alone. A follow up, in form of e.g. surveys, workshops, open discussions, etc., allows researchers to gain qualitative information for further analysis;
- after becoming aware of and learning new content, people enjoy exchanging ideas, views, and thoughts;
- qualitative measures gained from the study can be linked with quantitative data (time spent in the harbor linked to visibility and morphological variables such as green, water, noise, etc.), but as soon as more complex correlations must be created, new methods have to be conceived.

6. CONCLUSION

In the future, the core game mechanics must be polished. Furthermore, research on how to include storytelling features in the overall experience is necessary. We must assess to which extent players seem to be able to draw conclusions about the relationships among physical behavior, their body's reaction, game data, and external stimuli. The game feature of immediate visual feedback must be studied further, since we gathered neither solid results nor reliable data about whether the game supports learning about healthy places. In the future, the integration of participants' bio data as agent into the gameplay may bring us closer to an answer. To do so, some technical improvement is needed, such as the smartphone flash not overheating during measurements. Whether this type of interaction enhances participants' health literacy emerges as a relevant research question for further study.
City planners and designers can learn from game design the conception of spaces that allow a playful and free interaction with the built environment. As de Lange maintains:

> Perhaps this is a contribution architects and other urban designers can make to the world of new media design: to design truly accessible and inclusive urban interfaces that engage citizens with particular issues and allow […] them to organize themselves and act.[34]

Since various games have demonstrated the suitability of urban space as game space, it is of great interest for us to investigate in a next step multifunctional urban spaces conceived by urban planners and designers that fulfill the demands of the more common land use – residential, commercial, business, and so on – and at the same time are designed with affordance to play, be active, and support healthy behaviors: urban spaces designed as game spaces.

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34 De Lange/de Waal: »Owning the City.«

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