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1 ABSTRACT

The issue of engaging citizens in urban development and planning has experienced a significant increase in recent years. Traditional planning, control and communication approaches are reaching their limits in a more complex stakeholder landscape and an increasing desire of citizens for engagement. Novel approaches to inform and involve citizens in a playful co-creation process are necessary. Serious games and gaming are increasingly considered as the magic bullet for elevated stakeholder involvement and citizen engagement in urban planning and governance. But they are also discussed as means to instigate learning and capacity building processes and to raise awareness for urban core topics. These learning processes can unfold in different formats, such as social or game-based learning. This paper investigates, if playing the serious game prototype 'Mobility Safari' instigates social and specific learning processes and motivates players for a playful public participation. The Mobility Safari is a serious game prototype that was developed for the City of Vienna, integrating Vienna's SMART city ambition to transition towards a more sustainable mobility system. The analysis illustrates that the serious game indeed instigates and evokes learning processes during the game play and in the debrief covering a broad range of different learning activities and social interaction. Incomplete rule-sets and un-governed situations triggered discussions where the players linked the game-with their real-world experience and were urged to confront those experiences and actual practises. On the other hand, the willingness for active participation, which indeed takes a lot of effort, could be observed less often. Our analysis suggests that Mobility Safari is indeed a suitable mean for learning processes and support in a moderate way the interest in participation processes. We learned that a careful design, facilitation and sufficient time for a debrief to reflect on the game experience is crucial for a deeper learning experience that is meaningful for real-world contexts.

Keywords: Fachkonzept Mobilität 2025, participation, mobility, civic learning, engagement

2 THE IMPACT OF SERIOUS GAMES ON LEARNING AND PARTICIPATION

Serious games, digital and gamified tools have recently experienced a strong proliferation, covering the fields of education, urban and community planning, transport or energy planning (e.g. Poplin 2014; Tan 2014). Games are considered valuable due to their capacity to mimic and represent complex real-world matters and allow players to explore and engage with these in an experiential way. In the game players can manipulate the system, see how the system responds and receive immediate feedback from the game on their decision making (Cumming et al. 2012). Thus, playing games triggers also different formats of learning, such as learning facts, finding common ground, conflict resolution, experimenting with rules or institutions and motivating goal achievement (Bluemink et al. 2010; Devisch et al. 2016; Hämäläinen 2011; Poplin 2014; Tan 2014) and are suitable a for playful public participation in urban planning (Poplin 2012).

Playing is a basic form of learning and the role of imaginative and social forms of play is crucial for conceiving and making-sense of the world (Huizinga 1999). Learning through playing was rediscovered with the rise of digital tools and the increasing popularity of (digital and serious) games. Serious games and gameful (rule-based) or playful (free-form) formats (Deterding et al. 2013) are considered beneficial because they provide immediate feedback to the players' actions, show immersive and entertaining aspects, foster the understanding of different perspectives through role-play, and support the understanding of complex systems by representing complex real world matters in an artificial game environment (e.g. Medema et al. 2016; Tan 2014). The safe game environment allows players to experiment, take risks, manipulate or explore different pathways without facing the real consequences or causing damages (e.g. Devisch et al. 2016; Juul 2011). They are pleasant and entertaining learning environments, because the game itself delivers balanced amount of progressing challenges, trigger social interactions, provide feedback loops and rewards, ideally encourage

replay (Gee 2005; Juul 2011) and encourage public participation in urban planning (Poplin 2012). From a 'serious learning perspective, games are praised to achieve learning objectives such as fact learning, problem solving, enhancing spatial sense and visual thinking, increasing literacy on selected topics, reflecting on complex problems, raising awareness, increasing media literacy, educating target audiences on specific skills, and building coalitions and networks (e.g. Erhel & Jamet 2013; Gee 2005). If such learning actions take place in group settings, where players interact with each other (i.e. in negotiating strategies, knowledge sharing, praising each other's achievement), learning is associated with social learning. Multiplayer games, such as 'Mobility Safari', merge specific fact learning and social learning (Hämäläinen 2011). A returning criticism stresses that players might be so immersed that they fail to achieve the learning objectives; another point of critique is that 'serious games' are sometimes too serious. Hence, the challenge is to integrate learning and participating issues into the game without spoiling the enjoyment and fun (Ke 2016).

3 PICKING UP VIENNA`S MOBILITY STRATEGY AS A TOPIC FOR THE GAME

In our research, we addressed Vienna's ambition to shift towards a sustainable mobility system and their interest to improve the general knowledge level and build up capacity of citizens by developing the serious game 'Mobility Safari'. In this article, we discuss our research question if playing the serious game 'Mobility Safari' evokes fact-based and social learning associated with urban complexity. We also expect, that playing Mobility Safari unlocks gameful participation actions and make the strategic mobility planning processes more transparent for citizens.

Vienna is a growing city with 30.000 additional inhabitants per year, corresponding to a proportional increase in the number of trips. The current modal split shows a distribution of 39% public transport, 7% bicycles, 27% pedestrians and 27% motorized individual traffic (MA23 2016). The city's main ambitions on mobility, as outlined in its SMART City Strategy, include strengthening CO_2 free modes such as walking and cycling and incrementally lowering the MIT to 15% by 2050, the introduction of new propulsion technologies for non-motorized types of PT by 2030 and MIT within municipal boundaries by 2050, the entire commercial traffic (source and destination traffic) should run CO_2 free and a total energy reduction of 10% produced by passenger traffic should be achieved by 2030 (City of Vienna 2016).

The city's ambition is also characterized by urgency: the mobility and transport sector accounts for approximately 27% of the global energy consumption and CO_2 emissions and 1/3 in the European Union (IPCC 2014). Furthermore, mobility is a major cause of urban noise- and air pollution, it impacts the urban carbon footprint and poses major constraints to quality of life (Batty et al. 2015). Hence, novel policies and experimentation with original mobility practices, that could influence current social practices, are important tiers for urban sustainability transitions. Modal choice, in particular, is the consequence of a mix of values, attitudes and perceptions (e.g. Hunecke et al. 2010) or economic viability (e.g. Van Exel and Rietveld 2009). Thus, the transition towards a more sustainable urban mobility system takes place in the social, physical and institutional context and depends on the active involvement and engagement of many different actors and stakeholders whose daily practices and mobility choices contribute to policy performance.

For the game development, following policies and strategies are considered:

(i) awareness rising among various actor groups,

(ii) informing these actor groups which resources are needed for 'green' mobility and 'sharing' projects,

(iii) support networking and trust-building to set up sharing initiatives and citizen collectives,

(iv) inform citizens on existing initiatives and

(v) support and integrate underrepresented groups.

4 CO-CREATION GAME DESIGN

In an iterative co-creation process professional and administrative planners as well as interested citizens and urban initiatives (e.g. LA21 groups) jointly created the game prototype. The co-creation approach was crucial to produce a locally embedded prototype with a meaningful and recognizable game narrative (see also Gugerell & Zuidema, 2017). Important game components developed in the co-creation process were:

(i) Translation of complex guidelines, strategies, and vocabulary into common and practice-oriented game elements and mechanisms (e.g. linguistic adaptation of the project descriptions, order the quiz questions appropriate to difficulty-levels)

(ii) Complement and prioritization of social game components/mechanisms (e.g. gathering community points, team building processes) and sustainable work flows (e.g. different steps for realizing aproject e.g. you need partner, you need money, you need permission)

(iii) Create tokens of different transport users and integrate the topic accessibility (e.g. wheelchair as a piece)

Mobility Safari is a co-located board game for four to six players. The game narrative is embedded in the local mobility narrative and the city's ambition for a sustainable, urban mobility system (City of Vienna, 2014, 2016). The game board represents the city of Vienna with distinctive local conditions (e.g. planed subway lines and development areas, Danube), giving a strong spatial reference (see Fig. 1).

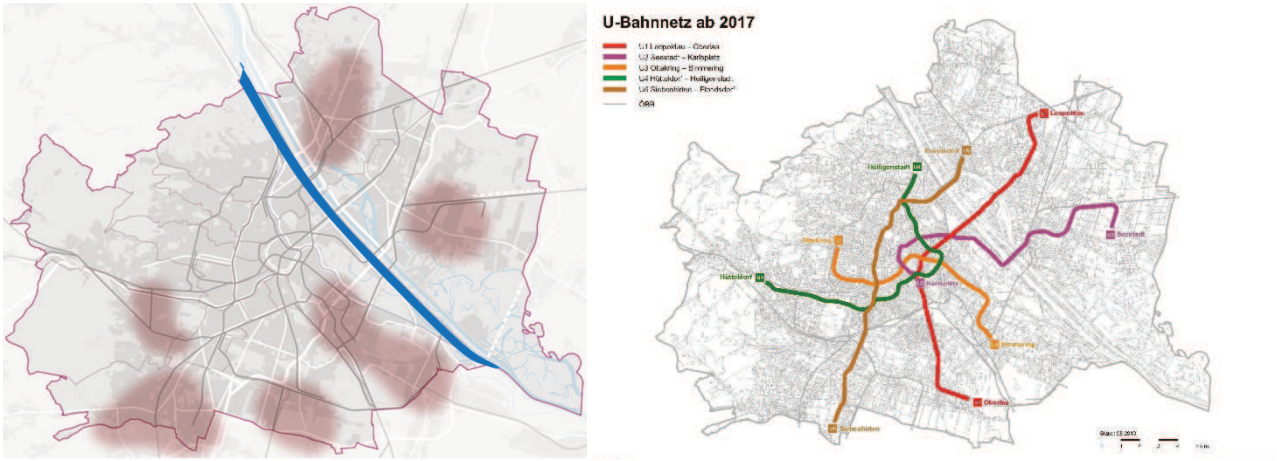

Figure 1: Development areas according to STEP 2025 (left) and planed subway network as of 2017

The game board is divided in differently coloured tiles that represent the main tiers of these policies (purple for 'innovation and learning', green for 'active and healthy', yellow for 'flexible and connected', red for 'fair and safe'). Players move their playing figure on the game board by rolling a dice and start or join mobility initiatives, develop new services and implement different projects. In doing so, they collect coins (financial aspect), community points (social aspect) and CO_2-reduction-points (environmental aspect).

Figure 2: Game board (left), different mobility initiatives (middle), counting board and tokens (right)

Arriving at a tile the player can decide on realizing the project, determined by the colour of the tile. The project cards are presented face-up, so the players can deliberately choose which project suits them most by checking and discussing different possible project types and required resources necessary for implementation. These requirements mirror a limited number of institutional, financial and social rules: (a) creating networks, (b) obtaining a permit (either by rolling a dice or answering a multiple-choice quiz question) and (c) funding the implementation and realization costs. Each implemented project provides the player network with a certain number of coins, community points or energy-reduction points. Players need to settle annually increasing mobility costs at the end of each game round, paying with the coins they collect when realizing projects. Additional quiz questions (e.g. number of bike-sharing providers, the average distance of a car trip in Vienna) and special action cards (e.g. elections, oil crisis, climate change) provide the players with factual, process and administrative knowledge to stimulate institutional and administrative capacity building process in a low threshold and entertaining fashion. Hence, the players are experiencing

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new perspectives, they are expected to learn about sustainable mobility initiatives and the game forces common learning between participants in multidisciplinary/multidimensional context (e.g. between planners, citizens, politicians etc.). At the end of the game there are three possible winning conditions: winners with the highest numbers of coins, community or CO_2-reduction-points.

5 METHODOLOGICAL APPROACH

The game 'Mobility Safari' was tested in spring 2017 with voluntary probands in Vienna. The research follows a mixed method approach, combining (a) a standardized questionnaire, (b) participatory observation during gameplay and (c) a debrief at the end of each playing session. Before and during the test phase various actions for recruiting voluntary players were utilized, including social media (e.g. Facebook, Twitter, Linked-in) and snowball sampling. The standardized questionnaire is literature based, querying (a) socio-demographic data, (b) knowledge and attitude towards environment, mobility, energy and participation, (c) player types and game preferences, (d) gaming experience and strategy, and (e) gaming/learning impact. The issues „specific fact-based learning", "social learning" and "participation" were sampled by inquiring the players' self-evaluation of their gaming experience. The completed questionnaires were coded with SPSS and analysed by descriptive statistics. The analysis was complemented by qualitative data on the playing processes, player interaction and decision-making processes in the game, collected through the participatory observation. Mapping player interaction is crucial to identify learning actions associated with social learning (Medema et al. 2016; Wendel & Konert 2016). The debrief was organized as a moderated focus group discussion, where the players jointly reflected on the game play, strategies and decisions taken and linked the gaming with their real-world experience. Serious gaming literature stresses the importance of debriefing to transform the gaming experience into a deeper learning experience (Lederman 1992; Crookall 2010).

In total 72 players tested Mobility Safari during 16 playing sessions. With an exploratory research focus we ignored a representative sample derivation. The sample shows a slight backlog of female participants and highly educated participants. Most players are between 19 and 30 years old, which represents the project's focus group of young adults. The sample is balanced regarding gaming abundance: 36% play games rarely to never, 25% occasionally and 39% play games frequently but with rather modest experience in serious games.

6 DESCRIPTIVE EVIDENCE AND RESULTS

The research illustrates that in general the players evaluate the urban game Mobility Safari as "fun-to-play": "It was great fun playing it" (77%), "the game is well constructed" (62%) and "The game is interesting and rich in diversity" (44%). Statistics also show a high willingness to replay the game (73 %). However, players who are active in community and participatory projects were slightly more positive about the game than the group of players who are not. Pursuing a sustainability transition by activating citizens would ideally cover all three types of learning: specific fact-based and social learning as well as learning for new social practises such as the willingness for active participation in mobility projects. While specific fact-based learning stands for an increase of technical-knowledge of urban mobility initiatives and projects, social learning considers the learning effects occurred by interactions with other players. The issue participation stands for increasing awareness and interest for participation possibilities and an active engagement in urban initiatives and development of new social practises. Figure 3 shows the self-reported answers of the standardized questionnaire:

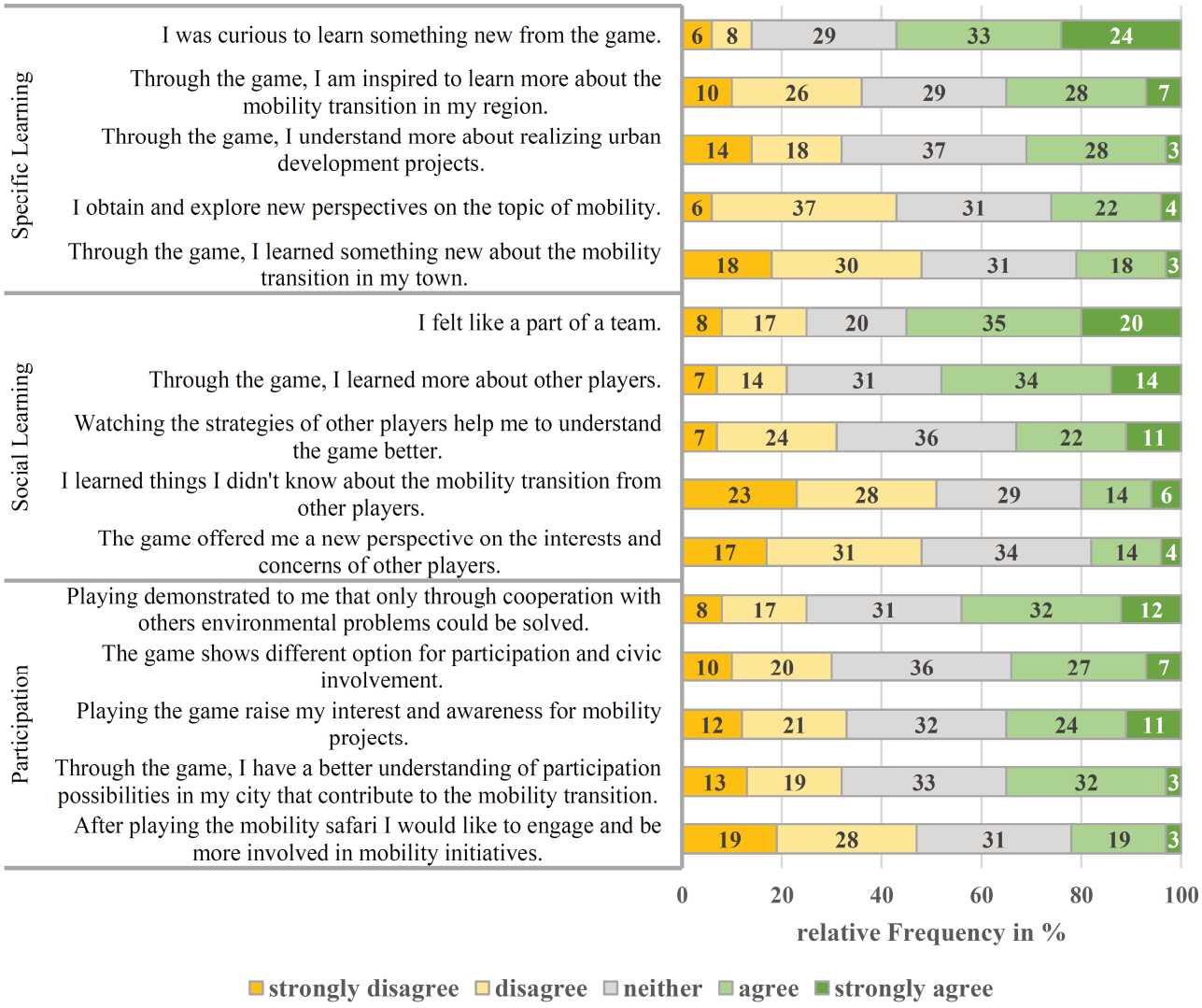

Figure 3: Results on the players' perceived learning outcomes (standardized questionnaire, n=72)

Specific fact-based learning actions occurred in the game besides the thematic action cards and the realization of mobility initiatives via the quiz questions. Two types of quiz questions were designed that correspond with the value (i.e. coins) of the chosen project card. The questions targeted schooling in the field of sustainable urban mobility such as providing information on bike-sharing, sustainable service providers, PT, CO_2 emissions and the urban carbon footprint. The wording of the multiple-choice quiz questions that included some smaller pieces of additional information, allowed the players to approximate the answers, by common sense and simple calculations, which was supported by the deviating choices.

More than half of the players stated that during the gameplay they learned something 'new'. More than 30% of the players indicated that they are inspired to learn more about the mobility transition in their region and gained a better understanding about urban development and mobility projects. About 25% of the players obtained new knowledge on urban initiatives and new perspectives on mobility which is crucial to consider new practises (see Fig. 3): "I learned about sustainable projects and ideas I had no idea about", and every fifth player stated that they have learned something new about the mobility transition in their town: "The game shows that every project has a sustainable influence on the environment". However, though learning occurred the players perceive their learning outcome rather moderate. That perception might be explained by the (a) slight overhang of well-educated people, who are already well informed in the sample and (b) given better education, that the set of quiz questions was probably too easy for that player group. Thus, the game indeed successfully delivers specific learning for information transfer and knowledge acquisition.

The quiz questions also delivered social learning, by triggering social interactions such as knowledge sharing and group discussions. In players compared their game experience with their real-world mobility practices and everyday life experiences. They expressed the value of the game regarding "Partnering up in a joint

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venture and not realizing projects on my own – and seeing the common benefit from realizing these projects". Such personal and professional experience also played an important role in the selection of game projects. The discussion around project selection reflects personal and professional values and preferences that are transferred into the game context: "No, electro-mobility-projects I do not support. That's not solving the traffic and mobility issue of the city" (G14). Debates about preferences and values are also put into spatial context: "No, for the Lobau (district in Vienna, N/A) a promenade does not fit – then I choose another tile and topic." (G12) and "(…) the most important strategy is, to choose for an urban development area, if possible a neighbourhood" (…) to enjoy the multiplier effects of neighbouring projects" (G15). The research aligns with prior research, e.g. Lozano (2014) or Medema et al. (2016) corroborating that playing the 'Mobility Safari' triggers social learning activities. By linking game world with real world practises, social values and norms shows that boundaries of the game world are permeable (see also Juul 2011)and that games indeed can be of value to better understand real-world complexities.

Next to the content specific group discussions institutional learning and capacity building occurred. Players indicated that they appreciated "Negotiating and cooperation with other players" and the "process of gathering a team of project members". The importance of building networks and collaborations to solve real-world environmental problems was agreed by 32% and strongly agreed by 12% of the players. The discussion strongly remained in the realm of daily practises and mobility choices and only rarely touched institutional and administrative questions, which indeed are less obvious or urgent in daily life.

The game activity instigated a positive team atmosphere. 82% of the players indicated that they actively considered them as a team member, and about half of the players stated that they have learned more about other players, such as different perceptions and interests, values and social practises, and watching other players elevated the understanding of the game (33%). Earlier we discussed the permeable boundary between game and real-world. Thus, watching and learning from other players in the game also transfers knowledge about real-world issues and delivers new insights for the development of new practises in it. To a lesser degree, they learned things about the mobility transition from other players and obtained a new perspective on the interests and concerns of other players (see Fig. 3).

Around 35% of the players stated that the game triggered their interest and increased their awareness about possibilities for participating in mobility initiatives. Still, only 22% would be interested to enter such initiatives and very few actively adapt and change mobility choices in their daily practices. Consequently, the game obviously works in terms of transfering information and rising awareness but falls short regarding triggering the players for active participation and behavioural change. Though the players are well educated with a comparatively high environmental friendly attitude, a game is likely not a format that works well for instigating active behavioural change.

In contrast to classic games, the gameplay of Mobility Safari based on incomplete rule-sets and un-governed situations. Thus it was necessary for the players to negotiate with each other and make decisions how to play in the specific unruled situation. Besides a cooperative teamplay and networking also "unsocial" or "unfair" decisions and practices occurred. To our curiosity, some players complained in the debriefing about the lack of predefined rules to govern such situations. Experimenting with new alternatives also included practices such as resource sharing, giving away resources as gifts to struggling players, but also included practices such as active bribery, corruption or usury. Addressing and discussing practices, institutional tensions, alternative institutional formats and the changeability of institutional designs are modest indications for a deeper and more complex learning process, in the sense to connect game experiences with real world matters.

7 CONCLUSION

In this article, we stress that playing the serious games 'Mobility Safari' indeed has the potential to increase the interest on urban development projects and reveals insights in their processes. The game delivered adequate results for schooling and transfer of specific mobility information to a broader audience. Hence, the game successfully supports the established goals of Vienna's SMART city strategy to raise awareness, inform actors on green mobility, sharing projects and existing initiatives, as well as support networking (City of Vienna 2016). The co-creation process during the game design process was crucial to develop the mobility safari and its components to actually deliver those positive effects. This participatory approach ensured the

implementation of target-group specific desires and needs, new perspectives and subsequently leads to a deeper understanding.

Less promising were the results regarding consolidated active participation. Though the game play and the debrief show indications moderate willingness to engage stronger in urban projects, obviously the players do not actively perceive them as learning processes and learning results. Subsequently, also the results in the questionnaire were modest too. For future research ambitions developing and testing formats that are stronger focused on behavioural change and actionable knowledge, and how to make this learning effect more obvious and perceivable for players, would be valuable to explore to improve diffusion and impact of serious games.

During the testing period, we also learned that the incomplete rule-set created added value regarding social learning: fuzzy and ambiguous, ungoverned situations enabled the players to experience institutional tensions. Those situations urged the players to solve these situations through social interaction and eventually alter the institutional design of the game. Hence, when gameful, consolidated learning effects for sustainability transitions is the ambition, incomplete and ambiguous rule-sets might be a suitable option to trigger different modes of learning activities, such as exploring new rules and collaborative formats. This finding adds to the traditional gaming literature that outlines unambiguous, fixed and binding rule sets as fundamental conditions for games (Salen & Zimmerman 2004; Juul 2011).

We also learned that the debrief is the crucial moment to transform the gaming experience into a deeper learning experience by discussing and reflecting e.g. institutional questions, which are not obvious to the players in the game play. Thus the debrief and the design of the debrief should be already considered and sufficiently addressed in the serious game design. Hence, it is also crucial to plan and allocate enough time for this activity: without a considerate debriefing activity, the learning experience and learning outcomes are likely to be lost. However, for future studies a stronger deliberation on how to address complex forms of learning and implement them in the game play in an adequate fashion are crucial. To measure and observe these different leaning forms a diverse evaluation design (i.e. standardized survey, participating observation and reflexive focus groups) will be necessary.

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