Smart Magic City Run: Exploring the Implications of Public Augmented Reality Games

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Abstract. This paper presents an augmented reality smart city gaming concept, Magic Run. Magic Run has entertainment value and fulfills its' original brief, but several aspects of the game were found to be problematic during a workshop with smart city researchers. We present problematic aspects of the game as well as ideas for how to redesign the game to control or ameliorate problematic interaction between future smart city players and bystanders.

Keywords: Augmented reality · Smart city · Pervasive games
Speculative design · Design fiction

1 Introduction

With smart city initiatives popping up left, right and center, questions that have confounded city planners and social scientist for centuries once more inscribe themselves in the physical environs and at the top of our agendas; who and what is the city for? According to a definition from the Centre of Regional Science at Vienna University, "smart cities" are characterized by (1) smart economy, (2) smart people (3) smart governance, (4) smart mobility, (5) smart environment and (6) smart living [8]. Many visions and definitions of smart cities firmly focus on information technologies that optimize resource flows of various kinds (food, people, traffic, decisions etc.) in a top-down manner, and it has been suggested that such visions are compatible with authritarian agendas [9]. What can be unequivocally stated is that many visions, by almost exclusively focusing on *technologies*, become bloodless and lack ideas or suggestions about how *humans* will live their everyday lives and partake in various social practices [16] in the smart cities of the future [4]. So is the future smart city primarily an efficient machine for transporting goods and people hither and dither or is it also a space for spontaneity, interaction, leisure and free play?

We assume the latter and here describe a student project that resulted in a concept for a pervasive augmented reality game, Magic Run[1]. The game concept has since been

[1] For more information about Magic Run, see the powerpoint presentation, the book chapter and the short concept movie at http://fom.csc.kth.se/archive/.

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"leveled up" by running it through smart city researchers who have scrutinized and noticed various troubling elements of the proposed game. We have then together redesigned the game by suggesting various improvements and suggestions for how the gaming concept (Magic Run 2.0) could be redesigned to better fit the reality of the smart future city.

Magic Run is a design fiction scenario [3, 7] that we believe could be realized 5–15 years from now; shorter if we assume Google glasses or goggles and later if we insist on digital contact lenses as the display technology of choice. The main challenge that Magic Run attempted to solve (or ameliorate) was an imagined future where an army of well-entertained couch potatoes did not get enough exercise [15]. Magic Run was our proposal for getting people outdoors, getting people to run and getting people to interact in and with public spaces.

2 Magic Run

After a long day at work you leave the office to go for your daily run and head to the nearby park. As you enter the park, butterflies appear around you and fluffy, friendly clouds cover the sky. It's time to warm up! Bright yellow stars start to appear over your head and you jump up and down trying to catch as many as you can in one single minute. After that minute has passed, your score shows +500 - a new highscore! Accompanied by the magical butterflies you let your pulse calm down while you run at a comfortable pace. But you shouldn't get too comfortable with that pace because now it's time for a sprint. A Magic Run colibri appears out of nowhere, flutters teasingly in front of you and then shoots ahead. You speed up and try to follow the colorful bird. As you catch up and your hand touches the colibri it disappears in a cloud of sparkles that earns you another +500 points.

This concept, Magic Run, has been developed to motivate people to exercise outdoors, transforming an activity that some might consider boring into a game, thereby tapping into additional sources of motivation. The original source of inspiration was the game "Zombie, Run![2]" as well as the immense success of the location-based mobile game Pokémon GO (it was downloaded more than 500 million times in the eight weeks following its release[3]). The Magic Run prototype combines the fun game mechanics of popular platform games (e.g. Nintendo's Mario games) with outdoors exercise. The user becomes the main character of the Magic Run game and the real world becomes a game world that the user interacts with through the movements of her own body. While the jury is out as to the sustained effects of gamification efforts in relation to medium- or long-term behavior change [10], we also note the huge popularity of apps that track and support exercise and fitness in the form of walking, running and cycling. The most popular app, RunKeeper[4], has 50 million users and we therefore assume there will be a market for a well-designed augmented reality app in that space.

[2] Six to Start and Naomi Alderman, 2012. See further https://zombiesrungame.com.

[3] See http://pokemongo.nianticlabs.com/en/post/headsup.

[4] FitnessKeeper, 2008. See further https://runkeeper.com.

The user can interact with Magic Run game objects in various ways, enabling different types of exercise. Collectables like stars are located above the user's head, encouraging her to jump, and catching a fast magical bird gives a concrete purpose to sprint intervals. These minigames bring more playfulness to the daily run, helping the user improve her physical fitness and overall health. It is possible to play Magic Run alone or together with others (cooperating or competing).

To implement Magic Run, we expect future augmented reality glasses or goggles that can augment the real environment with digital content. Combined with GPS technology and a depth sensor, it ought to be possible to play Magic Run in the near future. While designing the game, weaknesses and deficiencies of available technologies should be kept in mind. Hovering objects like butterflies and clouds are easier to blend into the environment than a tree that grows from the ground up, and a colibri (floating in mid-air) is preferable to rendering a rabbit running on the ground (which was part of the original game concept). Smart design of the game world can thus help obscure flaws and alleviate weaknesses of the current state of the art of augmented reality technologies.

3 Augmented Reality Game Challenges

The success of Pokémon GO[5] has led to many questions about health and safety. While the game does get people out and moving, including parents playing together with their children [17], there have also been reports of people engaging in problematic or dangerous behaviours, for example trespassing, suboptimal parking or risky driving [12]. There is also parental concerns about safety in real-world environments [17], not the least due to examples of a blatant lack of normal risk assessment; four teenagers had to be rescued from a vast mining complex where they had gone to catch Pokémons [5] and two men in the US accidentally fell off a cliff while playing [11]. An informant in the study by Sobel et al. [17] pointedly said *"I don't want my kids to be the dumb dumbs who fall of a cliff or [get] run over by a car because they [are] too engaged*." Media reports of dangers often emphasize straying into the wrong *places*, but the more widespread risk is that of *movement* in combination with reduced environmental awareness of road traffic [6]. This ties back to early examples of mobile gamers "*colliding with strangers when playing*" [2], but, if this happens while *walking*, what then are the possible consequences of playing while *running*? The faster speed and the shorter time to react to dangers together with the excitement of the gameplay and a lack of attention to the surrounding non-virtual environment could be a toxic cocktail. These dangers are an *intrinsic* part of the game and they represent problems the original Magic Run game design did not consider.

Beyond these direct risks, it is also possible to imagine that various forms of "non-conformist" behaviour could elicit negative reactions from bystanders. In a text that received much attention, Akil [1] discussed risks for black American men to play Pokémon GO in light of the possibility that (a) someone calls the police because a

[5] Niantic, 2016. See further: https://support.pokemongo.nianticlabs.com.

black man is exhibiting unusual or inexplicable behaviors and (b) some policemen might be prone to use powerful means to "control" the situation, up to and including employing potentially deadly gunfire. If mere existence in public spaces (being at the wrong place at the wrong time) can put black American men in harm's way, what then about someone inexplicably jumping, running, panting, shouting or suddenly changing direction and running *towards you*? The risk that such behaviors could frighten people in public spaces and elicit potentially dangerous reactions seems quite high (especially in societies where gun ownership is widespread). The disproportional distribution of such risks between social and racial groups points at the need for broader change in society. Still, the risk that all groups and all types of players can be misunderstood and perceived as behaving in dangerous ways is something that to the highest extent possible should be mitigated by redesigning the game.

It should be noted that some researchers have pointed out that most pervasive, location-based and mixed reality games are designed to provide players with limited experiences, e.g. *"The majority take the form of treasure hunts, where players must visit real-world locations in order to tick off game-world tasks"* [14]. While the call for games that provoke, that cause *"anxiety and exhileration"* and that are designed to be *"in opposition with, or disruptive of, social rules of the environment in which they are played"* [14, see also 13] is extremely intriguing, we deem it less suitable in this particular context as we potentially are dealing with people's health and safety.

4 Redesign and Outcome

If Magic Run and similar games potentially endanger the lives of its users, we urgently need to discuss possible changes in the design of the game. We will briefly discuss three avenues of thought to that effect, the first being aimed at increasing the security of bystanders, the second at increasing the safety of players and the third discussing emergent norms that mediate between bystanders and players.

Bystanders. It is crucial to redesign Magic Run in such a way that it does not become a public disturbance, for example by avoiding rewarding or encouraging behavior that could lead to annoyance or anxiety in bystanders. Jumping up and down in the same place (catching stars while warming up) might be ok but making giant leaps over imaginary obstacles less so. Using a large stone or a bench as a stepping stone to jump and reach higher could be a borderline case. It is an open question whether the game, using microphones, should penalize shouts and other outbursts that could worry bystanders, even though it would be thought provoking to for example encourage players to shout simultaneously (also enabling them to identify each other). The implications for public safety, anxiety and annoyance unfortunately highlights an innate tension with some of the core pleasures of playing the game (i.e. jumping up in the air to catch an imaginary star, see further Fig. 1 below). It might be possible to map game content to physical aspects of reality by aligning the placement of stars that can be caught just below trees with low-hanging branches. It would not look particularly strange to jump at such a place in comparison to jumping as high as you can "in the middle of nowhere".

Fig. 1. In the same way Mario jumps to catch stars and prizes in classic platform games, so could you become the hero of your own game by combining gameplay with moderate or vigorous exercise.

Players. The safety of players is very important as aspects of physical reality - dangerous terrain and especially traffic – could constitute risks for players. One possible solution is to restrict the game in space, making sure that it is only possible to play Magic Run in geofenced "safe" areas (for example in parks or designated forest or jogging trails). This opens up questions of how such spaces should be selected and by whom? We suggest a tight integration with data from geographic information systems (GIS) to find suitable areas. Such top-down data can however be incorrect or out of date and we would also suggest bottom-up approaches. Assuming that runners in general tend to seek out areas that are suitable for running in terms of safety and comfort, a running app such as Runkeeper could be mined for data about suitable locations and tracks in much the same way that Niantic used the database from their previous location-based game, Ingress, in the design of Pokémon GO.

Emergent player-bystander norms. Just as bystanders now understand that people seemingly talking to themselves most probably are talking in a mobile headset, we here assume that norms and practices around an augmented reality game like Magic Run would change over time. It could for example be the case that players prefer to use tight-fitting goggles rather than glasses and that such goggles will become the equivalent of a headset - signaling that the player is partially enclosed in a virtual world. This would furthermore seem particularly probable if the player is dressed in a tracksuit. Playing only in certain (geofenced) areas would also make it easier for both players and bystanders to successfully negotiate the use of public spaces despite the fact that there again is a basic tension between the sheer annoyance of bystanders minding their own business (strolling, having a picnic etc.) in relation to the chance that a player becomes absorbed in the gameplay to the detriment of other people's use of public space.

Space does not allow us to elaborate on these and other suggestion here but for one last idea. If augmented reality glasses become popular, it would be possible to imagine that bystanders are allowed a limited shared augmented reality view, for example in the shape of visible slipstream (glitter dust or some other customisable visual effect) that would follow Magic Run players and that would help bystanders understand players' mildly unorthodox behavior in public spaces.

5 Future Research

While we have concentrated on a limited number of issues in this short paper, e.g. on increasing the security of bystanders (by not freightening or annoying them) and on increasing the safety of players, it is possible to discern specific themes in the paper that we suggest should be addressed by future research. We need more research on:

- Social and power-related issues in relation to the unequal risk of becoming the object of suspicion by others.
- Evolving signaling strategies and the negotiation of acceptable behavior in the nexus of (novel) technologies and social practices in public spaces.
- The creation of more site-specific experiences through the sourcing of geo-data about features of the urban environment and bottom-up data about (in this case) runners' preferred routes.
- How to protect players from road traffic and other unsafe situation by manually or automatically geo-fencing suitable tracks or spaces for players.

6 Discussion

We have here presented a concept of a smart city pervasive augmented reality game, Magic Run. We have also discussed possible complications when the game is played in public spaces in the future smart city as well as some suggestions for ways to ameliorate said problems. Visionary Xerox PARC researcher Alan Kay said almost 50 years ago that "*the best way to predict the future is to invent it*". While Kay and his collaborators at Xerox PARC literally built parts of the future we now live in from the hardware and up, we have instead designed the future through the use of a speculative design scenario [3, 7]. By doing so we hope to open up the space for debate, discussions and social dreaming [7] about the future smart city to broader groups of participants than just engineers and software developers – because the city belongs to everyone who lives there!

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