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## StreetWise: a valid ecology for a serious game in a secure forensic mental health setting

Paul Hodge<sup>a</sup>, Jacqueline Davis<sup>a</sup>, Neil Maiden<sup>a\*</sup>, Bradley Mann<sup>b</sup>, Aili Nidsjo<sup>a</sup>,  
Alan Simpson<sup>a,b</sup> and Lisa Reynolds<sup>a</sup>

<sup>a</sup>City University London, Northampton Square, London EC1V 0HB, UK.

<sup>b</sup>East London NHS Foundation Trust, 9 Alie Street, London E1 8DE, UK

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### Abstract

To ascertain their readiness to be discharged from care, secure forensic mental health service users are often given restricted access to their local communities. However, this can be stressful for the service user and expose the public to potential risks. Therefore, new research was undertaken to explore whether a computer-based serious game could enable service users to explore their responses to community based risk situations in a safe environment. Creating a serious game for use in a secure forensic mental health setting is itself both novel and problematic, and the initial research sought to test the feasibility and acceptance of the game. This paper reports first results from working with service users to develop a prototype game that accurately describes their experiences and expectations to lay the foundations for a clinically effective tool and achieve acceptance.

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### 1. Introduction

The purpose of the research was to deliver a game to support and enhance the rehabilitation of forensic mental health service users detained in a secure setting prior to their discharge and return to the community. The initial

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\* Corresponding author. Tel.: +44-20-7040-8412 ; fax. +44-20-7040-8859  
E-mail: [N.A.M.Maiden@city.ac.uk](mailto:N.A.M.Maiden@city.ac.uk)

phase reported in this paper was to address the feasibility and acceptance of a serious game in this domain, and in particular to provide a game ecology with an acceptable degree of validity needed to deliver a clinically useful tool and gain acceptance by service users<sup>1</sup>. The name of the prototype game was StreetWise, a name suggested by service users during a user-centred design process.

Users of secure forensic mental health services tend to operate at the margins of society where drugs and gang culture are rooted and interactions with authority are problematic. The service users, by definition, have difficulties in managing their mental health, a majority are diagnosed with schizophrenia, and there is a high concentration of cognitive and learning and dysfunctions. A prison record is common, and most have a history of drug and alcohol misuse. For pre-discharge service users, the skills required for independent and safe living are difficult to develop within the secure setting. To ascertain readiness for discharge, these service users must be given access to the community, which can be stressful for the service user and expose the public to potential risks. Therefore, a requirement on StreetWise was to enable service users to explore their responses to risk situations, such as peer pressure to offend, within a safe context and to consider alternative ways to react.

The user-centred process applied in this work involved service users in the design of StreetWise. A group of secure forensic mental health service users attended a series of workshops to participate in the development of an engaging and relevant game with realistic scenarios, environments, characters and motivations. The prototype focused on alcohol and drug use, which were recognized as initiating negative cycles that can result in institutionalization. To work in a secure setting with the service users required UK National Health Service (NHS) ethics committee approval and approval at NHS Foundation level for the research and development and proactive service providers to enable effective access to service users in a high security environment.

The remainder of this paper is in 5 sections. Sections 2 and 3 report previous research that underpinned the development of the prototype game and how user-centred practices were adapted to the secure forensic mental health domain. Sections 4 and 5 describe the prototype version of StreetWise and results from a first evaluation of it with service users and service providers who were not part of the design process. The paper ends with future work required to take StreetWise to the next stage of development in this challenging sector.

## 2. Research Review

Evidence indicates that serious games can be effective in mental health contexts<sup>2,3,4</sup> and encourage desirable patterns of behaviour<sup>5,6</sup>. Digital-media presentations can be an effective diagnostic tool in a secure forensic mental health context that is not only acceptable to offender patients but also can more effectively engage their emotional reactions than other approaches<sup>7</sup>. A growing body of research reports the advantages from the use of simulated and virtual environments within mental health<sup>8,9</sup> and frameworks have been suggested for their evaluation<sup>10,11,12</sup>.

Moreover, the need for training and assessment tools with a higher degree of ecological validity in secure forensic mental health settings is an established and defined challenge<sup>13,14</sup>. Ecological validity is essential for clinical effectiveness and to provide accurate diagnostics of service user behaviour and self-management. It is an established important consideration in simulations<sup>15</sup>, and the American Standards for Educational and Psychological Testing provides criteria with which to qualify the ecological validity of virtual and simulated environments<sup>16</sup>. For serious games to elicit valid responses from players, players should be in a flow or near-flow state that will facilitate less guarded and more natural behaviour<sup>17</sup> – Ermi and Mayra report how “...the player becomes entirely focused on the game world and its stimuli”<sup>18</sup>, and such conditions are needed if secure forensic mental health service users are to provide instinctive rather than considered responses in different game situations<sup>13,19</sup>. Indeed, engagement is a highly examined product of gameplay<sup>20,21</sup>, and a means to achieve greater player engagement in serious games is realism<sup>20,21</sup> – a game that provides an ecology of recognizable and realistic locations, characters, narrative/scenarios, jeopardy and reward will elicit engagement.

Generating the realism required to create a valid ecology for StreetWise was perceived to be a major hurdle, especially with incarcerated service users. Therefore, we took inspiration from various sources including reported requirements discovery practices with outlying user groups<sup>22,23,24</sup>, and good co-design practices such as providing food in workshops and producing memorabilia and paper handouts, to help elevate service-user feelings of involvement and importance to the project.

### 3. The User-Centred Design Process

Before running design workshops in secure facilities, the research team joined meetings of a community-based mental health service user and carers group<sup>25</sup>. Mixing with people who had firsthand experience of acute mental disorder allowed unacquainted research team members to gain insights into the needs and concerns of service users and their relationship with existing therapies and support systems. The meetings also presented an opportunity to practice potential workshop strategies and explore a basic game structure. This structure was arrived at under the guidance of experienced service providers, and led to a game loop based on the practice of rehabilitation. This game structure provided a clear and defined foundation upon which to design with the service users in the workshops. The structure also helped ensure that the research question was addressed within time and budget, avoiding feature-creep.

A total of 3 workshops took place with groups of service users in a secure setting, and 4-5 service users attended each workshop from a pool of 8 service users who had volunteered. All volunteers were males between 20 and 50 years of age and preparing to be discharged from secure care. A total of 2-3 service providers and 2-3 researchers who facilitated also attended each workshop. A further 2 meetings were held by 2 researchers, each with a single service user, also in a secure setting. The single sessions provided a different dynamic, with an emphasis on considered reflection compared to the more chaotic design work of the group workshops. One of the facilitators who was also the game developer attended all the workshops to acquire a first-hand understanding of the domain, service users and their requirements.

The materials that could be brought in to the secure facilities were understandably limited. Researcher's mobile phones and laptops along with items like keys, wallets and belts were not permitted. Once in the facility the access to equipment and amenities, particularly the Internet, was also severely restricted. However by prior arrangement a basic range of creativity tools including pens, paper and printed matter was permitted. All of the service users were able to participate in the workshop to design StreetWise without any significant language or other barriers, in spite of the poor English language skills of some of the users and period of incarceration of others during which digital technologies have evolved – it is not unusual for service users to have been in secure settings for over a decade with very restricted access to mainstream media. The volunteering process to participate in the project may have skewed the sample to a degree, and future developments of StreetWise will need to address a wider spectrum of pre-discharge candidates. All the workshop volunteer service users expressed positive attitudes about their involvement in the development of the game, and remained cooperative and engaged throughout.

As previously stated, a major aspect of the workshops and meetings was to collect descriptions of credible characters, environments, scenarios and gameplay motivators such as punishments and rewards from the service users. An iterative approach was taken, and any implementation of cues from one workshop were presented for review in the next. For instance, the user-centred design process in the development of a location for StreetWise included the following steps,

- Ice breaker techniques were used at the start of each workshop and between and changes of topic. This involved facilitating a period of untargeted conversation before each scheduled agenda item was introduced. The tone throughout the workshops was casual, and the service users had continual access to the food and soft drink – these periods allowed the researchers greater insight and understanding of the service users;
- The service users were asked to talk about the kind of locations that they expected to be in the community after they have been discharged;
- Neutral images were then collected via an internet search of the more popular types of location mentioned, and the service users were asked how strongly each image portrayed a place they identify with. Passing round printed images permitted each service user a platform to speak without (too much) interruption and as a focus for their input;
- Encouraged to talk further about the stronger images, the service users described the positive and negative activities that they or others may undertake in each area related to substance abuse. While the atmosphere in the workshops was relaxed and the service user's anonymity was assured, it proved beneficial for the facilitators to regularly ask the service users to describe what they believed others may do. This use of 'someone who isn't me' was effective in eliciting a more diverse range of responses and could also provide a useful contrast to an initial

personalized reaction. Often the service users would automatically describe the behavior of 3<sup>rd</sup> parties, even when prompted to talk about themselves;

- Through this process the source imagery was derived for a location familiar to the service users, and where their behaviour will be challenged on return to their communities;
- The location was further honed by service user feedback to the in-production game asset at subsequent workshops. Relatively high fidelity material presented for review to the service users, in the form of photographic imagery or polished game assets. Other research had suggested that the basic mock-ups and sketches acceptable in a mainstream context may prove problematic in such marginalized domains<sup>22</sup>, but productive responses were given to the high fidelity presentations.

The same approach was taken to create the characters in the game. The service users were presented with a collection of relatively neutral images of potential characters, filtered from their initial descriptions, and asked to talk about them further. Again the more significant images were drawn on as inspiration for the behavior and look of the game's characters, and then further developed by collecting the service users' feedback about the in-production game assets.

The exploration of the characters and environments during each iteration facilitated the capture of first-cut scenarios. The resulting StreetWise prototype game incorporated authentic scenarios and character dialogue about the service users' drug and alcohol use that was central to the therapeutic function of the game, peer-based situations in the community that motivate for and against good self-management. Some of the scenario development pushed service provider's knowledge of the service user's world, for example the extent to which drugs are used by dealers to entrap users, and the degree of separation between service users' personal and street personas. The suggested scenarios often had interesting characteristics – there was a strong belief among the service users that drug dealing was both easy and profitable, and that being institutionalized was desirable and not to be avoided. Some of the game scenarios involved extravagant rewards and/or violent punishments. Consequently many of the scenarios required sensible moderation by the researchers and service providers to ensure that they remained authentic but a better fit for the needs for rehabilitation. The scenarios were also carefully broken down into dialogue elements by the game designer to seed challenging nonlinear storylines based on the player's decisions during gameplay. Once amended, and following the iterative development approach, the scenarios and dialogue were represented to the service-users for their approval before being recorded by voice-artists. The single service user developed the basis for two of the eight scenario progressions recorded for the prototype game.

The workshops spawned numerous pertinent and exciting suggestions for game features and the potential therapeutic and educational context of StreetWise. As there were too many ideas to action within the scope, time and budget of this initial stage of research, they were documented for future reference.

#### **4. The Prototype StreetWise Game**

The StreetWise prototype game was developed using the Unity 4.5 game engine, Autodesk and Adobe software tool suites, Algorithmic substance materials and Mixamo animation utilities. Some pre-made textures and models were purchased to deliver the prototype within the project deadlines and budget, although whenever possible, we sought to develop bespoke artwork to represent service user needs. These tools enabled a pipeline that satisfied the need to rapidly iterate ideas for presentation to the service users in the workshops and to generate a robust build for evaluation, Unity builds were deployed for the web-browser.

Use of StreetWise did not need any expensive or intrusive equipment because of the restrictions imposed by using unusual technical equipment in a secure forensic mental health setting. Moreover, stakeholder consensus was for a simple pick-up-and-play game on a desktop computer or tablet with the potential for on-demand self-application. Therefore, while the therapeutic success of many games for health derives from the use of additional equipment, the first design of StreetWise used traditional game mechanics to rehabilitate and monitor progress, although future versions of the game might use biometric measuring devices for evaluation purposes. The prototype implemented features to a degree deemed sufficient to address the remit of the initial research question, matching budget and schedule constraints against realizing the service user's ambitions expressed in the workshops.

The game loop of StreetWise was simple and based around the scenarios elicited from the service users [fig. 1]. As a player explores the game location from the first-person-perspective, different game characters present different choices for the player to select or disregard. Some of these choices were deemed to be of lower risk to the player than others. For example, choosing to visit the Job Centre was of less risk to the player than choosing to smoke crack, and the game evaluated the player accordingly [fig. 2]. In the current version of the game, each player went through 3 rounds of choices and decision-making. Each successive round was populated by characters who react and provide further choices that were consistent with the choices made in previous rounds, so that an engaging and coherent story emerged [fig. 3], based on story paths generated as part of the StreetWise scenario engine. At the end of each round the game provided feedback on the choice made.

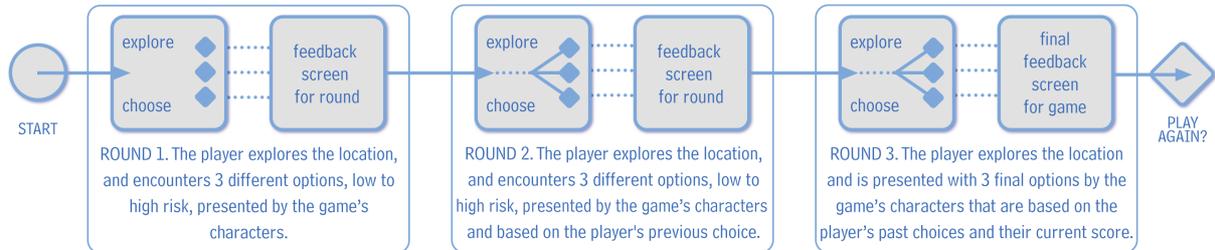


Fig. 1. The prototype game flow.



Fig. 2 Screen shots and abbreviated snippets from the spoken dialogue in StreetWise demonstrate 3 types of choices that may be presented to the player in round 1. Left to right the panels represent choice scenarios of, high-risk, low-risk, and medium-risk.



Fig. 3 Screen shots and abbreviated snippets from the spoken dialogue in StreetWise demonstrate how a story path with a particular character may develop over 3 rounds depending on the choices the player makes and random seeding from the Scenario Engine.

The scenario engine introduced a level of randomness to each game by seeding from a bank of interweaving scenarios and attributing them to suitable characters. It also reacted to how well the player was doing by utilizing weighted scenarios to provide easier or harder gameplay [fig. 4] – choices that were previously rejected were

presented more vociferously in next round, the risk level of scenario options may be increased or decreased, or, in the final round, the same character may change from a low risk to a high risk option, within the context of the storyline. In the prototype game the scenario engine can generate over 30 unique story paths, enough scenario dialogue has been recorded to generate far in excess of 250 individual gameplay experiences. Our intention was that the scenario engine will eventually provide personalized, immersive and emergent-like game play, allowing service users and service providers to customize the game for individual therapy requirements.



Fig. 4. Screen shots and abbreviated snippets from the spoken dialogue in StreetWise demonstrate how a player doing well is confronted by a more powerful negative scenario choice, and a neutral option is replaced by a Trojan-horse, higher-risk, scenario choice.

## 5. Evaluating StreetWise’s Feasibility and Acceptance

While there was already good evidence for feasibility and acceptance for StreetWise from the development process, we also undertook a first summative evaluation with service users. The StreetWise prototype was evaluated by a new group of 6 volunteer service users who had not been involved in the game development. Each service user was observed playing StreetWise individually for 10 to 15 minutes before participating in a group debrief. The observations allowed the researchers to informally assess the participants’ engagement with the game and their ease with its interface and general comprehension of the concept. The group debrief ascertained how accurately the prototype game depicted the service user experiences and had matched their expectations, and capture service user perceptions about using StreetWise as a therapeutic and educational tool prior to return to the community. As in the design workshops, the atmosphere was kept informal in the debriefing, and while the researchers facilitated and initiated responses via scripted questions, the conversation often had a life of its own and information flowed freely – the service providers, always present due to security and safety protocol, were also keen to ask the service users about their feeling and thoughts in respect to their experience of playing StreetWise.

The 6 service users in the evaluation had various levels of gaming experiences. Some reported being keen gamers, while others stated that they had played very few games, often many years previously. All but one played the game with both ease and enjoyment. The user who had difficulties – he had instantly pressed a ‘select’ button before exploring all the game options - had most reservations about the game in the debrief, saying “It’s just the same thing again and again and again” although he went on to be very complimentary about the realism of the game characters and said, “This girl approached me, ‘do you want some skunk?’ And she, she started grabbing hold of me and kissing me, and that character just reminded me of her, yeah.” All the participants made highly positive comments about the level of realism found in StreetWise, for example “Even the lingo, like the action was correct, the slang terms, everything was correct, that’s, that how they’re going to approach you.”, “Movement of the body as well was correct, the body language, everything.” Remarks of this nature demonstrated StreetWise incorporated credible characters, character dialogue and scenarios. The service users also confirmed that the park was a suitable location. Although the park in StreetWise was a reimagined assemblage of images gathered from an internet search, as described in section 3, and deliberately did not represent any identifiable local park, unprompted, a couple of service users were convinced that they had previously physically visited the park depicted. However, because the

game was a prototype, it lacked the breath of content found in the commercial products more familiar to the service users, and some picked up on this, “I don’t think I’d keep going back to it, because there’s not a skill level, like FIFA or something, in it”. Many of the service users also requested a more free-roaming environment, frustrated that they could not explore the street seen from the park. These remarks underlined the need to present high fidelity material to service users, and the service users were quick to mention aspects of the prototype that lacked the depth and polish found in commercial counterparts. As in the workshops, the service users were eager to suggest possible future features and uses for StreetWise.

Crucially, all the participants were keen to see the adoption of a serious game as part of their therapy to prepare them for discharge. One service user reported “And having, have it put into psychology sessions, like he said, as well, individual one to one sessions, where the psychologist would bring the laptop and the, the joystick. That’s a good idea. And we could do it like that as well, so she can see what we’re thinking regarding what we’re going to be like once we’re discharged, you know?” The service users found StreetWise engaging and challenging, though from the observations and feedback from the debriefing, it became apparent how regularly the service users selected the high risk options, and it was only the feedback from the game that made the poor choice clear to the player.

The results from this evaluation provided first qualitative evidence that the adopted user-centred design process had led to the development of a game ecology that was valid to the service users. Furthermore, to investigate the depth of acceptance of the computer-based serious game in the forensic mental health domain, 8 clinical and administrative professionals were also interviewed individually. After being shown the StreetWise prototype, the service providers were encouraged to express their thoughts about it. The professionals were both cautious and enthusiastic, for example: “It would be good as long as not relied on too heavily and part of a wider risk assessment” and “It is an intervention in itself. Opens the door to other discussions. Conversation starter”. A nurse expressed a belief in the potential of StreetWise to foster service user autonomy and ability to make good choices, “Anything that promotes positive choices for patients, I think is a good thing. I do think our patients, in particular, struggle with like social interactions, I think in general, and also being able to make those positive choices. It’s interesting when you take them out on leave and someone says maybe, hello, to them randomly at a bus stop, some patients actually look to the staff first. It’s really interesting how we, our service, can infantilise patients but actually that’s rehearsal. So I think that rehearsal and sort of mentally telling yourself about, if this comes to me and preparing yourself for a response, I think would be really helpful.” Overall the 8 service providers were intrigued and, like the 6 service users, saw strong potential in the game as a therapeutic tool.

## **6. Future Steps**

The interviews with the service providers in the evaluation process requested StreetWise to reinforce intended outcomes such as medication compliance, coping techniques, assertiveness techniques, and how to say no without being aggressive outside of scheduled therapy sessions. We will continue to develop StreetWise to support the achievement of these outcomes. The evaluation revealed that StreetWise provided an acceptable level of ecological validity, although one service provider, a psychiatrist, expressed concern that “Service users may potentially fake it”. Therefore the game needs to be developed to safeguard against potential subversion and misuse by service users. To this end, future research is planned to test a set of documented strategies for measuring player engagement using the StreetWise prototype.

For service users, StreetWise needs to empirically improve their self-management, preventing risky behavior, and increase their esteem and confidence - and be fun to play. Feedback from the evaluation was positive in respect to the direction of the game and the degree of realism afforded by the existing ecology. Feedback also made it clear that Streetwise needs more content, and the initial phase of research reported in this paper uncovered and captured over a hundred discrete stakeholder ideas to be mined for future features. That said, the generation of an appropriate level of ecological validity remains key to delivering clinical value from StreetWise. Therefore, future research will pursue methodologies that can grow and measure a valid game ecology, to deliver the player life-like imperatives and deliver accurate and actionable diagnostics. A website is available to explain and track the progress of the StreetWise project, [www.streetwise.website](http://www.streetwise.website).

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