The Importance of Game Jams in Serious Games

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Abstract: While the concept of game jams has been around for a number of years, their potential as a viable design research method has yet to be realised. This paper will provide an insight into how game jams can be beneficial to the research community by exploring how they can tackle difficult research questions and disseminate information in an effective and engaging manner. Game jams are evolving, they are moving beyond the idea of creating games for entertainment and are instead focusing on using data in ways that can help solve specific issues and real world problems. The *noPILLS* project was a European research project with the long-term aim of reducing pharmaceutical micro-pollutants in the water cycle. The aim of the jam was to produce games that would make a complex scientific and environmental issue understandable and accessible. A total of 10 participants took part in the 48 hour game jam from which three games were produced; *Sewer Sweeper*, *Polluted* and *Purity*. *Sewer Sweeper* is a first person shooter that teaches players about water filtration by offering them the opportunity to select different zones to play in, all of which are reflective of rural and urban communities. *Polluted* is a game aimed at young children. It teaches them about the effects of sewage in the water by concentrating on the effects this has on marine life. *Purity* is a simulation-based management tool designed to be used by professionals or final year University students to educate them about the management of a water treatment plant with a focus on filtration methods. The research partners involved in the *noPILLS* project were very satisfied with the games that were created during the jam. All three games were funded by the partners to be fully developed. The paper will discuss the both the benefits and drawbacks of using game jams by using the *noPILLS* project as an example.

Keywords: game jam, games for research, serious games, participatory game design.

1. Introduction

Video games have emerged as a twenty-first century method of approaching high-level problems that are otherwise difficult to comprehend. Players are afforded an outlet to understand complex situations through serious games and game simulations (Michael and Chen, 2006). The sophisticated and attractive activity allows publics to interact with subject matter in an enjoyable environment. This has resulted in a rapidly-developing approach to disseminating information and connecting with the public, and has increased the pervasiveness of experiential gaming technologies for wider purposes, labelled "serious games" (Zyda, 2005). The authors argue that the development of serious games, evident in health (Baranowski, 2008; Thompson et al., 2010), education (Prensky, 2001; Krajewski, 2014), and lifestyle (McGonigal, 2015), will become a more frequent practice in academic research. As a result of this, the authors present a case for the use of the game jam format within the use of serious games as a research method.

Game jams have become increasingly prevalent in the past few years. Game jams are team based events that bring together people from diverse backgrounds to create playable games in a short, predefined timeframe (Kaitila, 2012). Their experimental nature provides the ideal environment for the rapid prototyping of new ideas. The thematic and time constraints in a game jam lends itself well to encouraging novel ideas and new ways of thinking in a safe environment. The games that are created during a game jam tend to be prototypes that are designed to showcase an idea. They provide a great way to test a concept and determine whether or not that concept should be turned into a full product.

From their inception, game jams have been utilised for the experimentation of ideas and possibilities. The *0th Indie Game Jam* (*IGJ0*) was created as an enquiry-based approach to explore technological potentials in order to progress the video game industry (Hecker, 2013). *IGJ0* inspired the creation of larger, more notable game jam organisation, such as *Ludum Dare* (*LD*), *Nordic Game Jam* (*NGJ*), and the *Global Game Jam* (*GGJ*). There is an evident increase each year on participating sites and developers, as well as submitted games, as exhibited by the *GGJ* (Figure 1). The increase in popularity of game jams has created a culture of intense, rapid, and iterative game development events within the games industry. The expanding culture of game jams requires a grasp of the functional and participatory properties within such events (Goddard, Byrne and Mueller, 2015) and in what ways to approach research purposes in game jam environments (Decker, Eiselt and Voll, 2015).
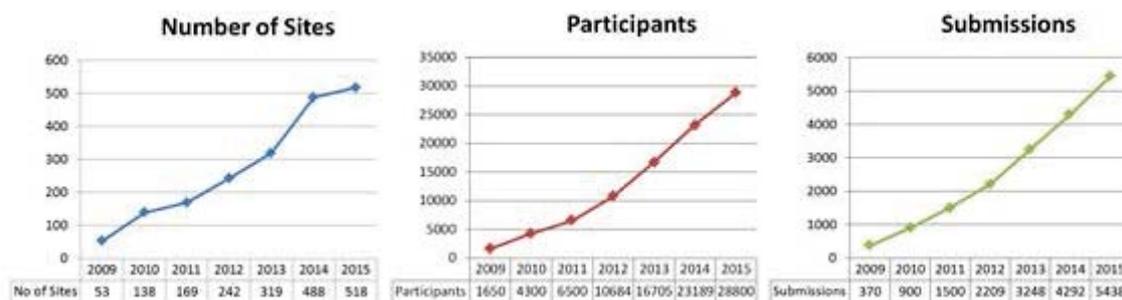
Figure 1: Statistics from the *GGJ*, as of 2015.

Game jam provide researchers with an environment in which they can collaborate to explore new ideas which otherwise might not be possible. This paper argues for the inclusion of game jams as a viable design research method.

2. Literature

2.1 Benefits of Game Jams

Game jams infer a number of benefits to the development of games. They offer a practical, forward-thinking approach within a highly-constrained environment in respect to time, resources, and skill level. Projected by the intensity from these elements, it promotes consideration of working towards outcomes that are achievable within this development environment that may be considered too risk adverse protracted otherwise (Cook et al., 2015). This greater facilitation for creativity under constraints not only relates to an individual's ability, or the quality of games produced, but also relates to the diverse approach by the participating groups to the same problem. This community-driven approach to solving problems allows for more innovative and viable projects to emerge from a wider consideration of perspective to the research topic.

The thematic development format also helps game developers consider design and technical solutions to wider contexts. Traditionally, game jams offer an abstract theme that allows developers to interpret and build games based on this influence. Game jams intended for serious game development can also encourage participants to think deeply about the problems associated with the theme, and design systems to address their interpretation of such problems (Cook et al., 2015). Involvement in game jams for wider research purposes promotes participant engagement: not only with the development of prototypes, but with the subject matter itself. The expectation to engage – in order to create effective and meaningful games – satisfies the intentions of thematic development associated with game jams.

The interdisciplinary, collaborative element accommodated by game jams is useful in addressing thematic and communicative challenges that may be difficult to overcome in more traditional models for development (Cook et al., 2015). Community-forming at game jams can be attributed to the intrinsic motivations to participate and implicit formation of teams to collaborate on common issues, contrasting to the engineered construction of communities at conferences, where professionals are categorised by tracks based on their discipline (Cook et al., 2015). By bringing multidisciplinary professionals together, diverse perspectives can be refined and developed with variants of skills, expertise and knowledge levels.

As was the case in *IGJ0*, game jams "have been noted to focus on experimentation and innovation, rather than polished products" (Decker, Eiselt and Voll, 2015). Fully-completed, polished projects are not the intended outcomes of game jams. Instead, game jams encompass rapid idea generation, creativeness, and play as central themes for development (Decker, Eiselt and Voll, 2015). They encourage participants to focus on a particular challenge and enquiring what is possible in a short space of time in order to address the situation. The thematic development process may increase the likeliness of generating further outcomes, such as future development of games or emerging research initiatives. This allows for an enquiry-based, "fail fast" approach that implicitly impacts wider outcomes (Decker, Eiselt and Voll, 2015) and allows for the most innovative and novel ideas to emerge.

2.2 Game Jam Adoption

Several environments have taken the initiative to adopt the format of game jams to capitalise on the rapid idea generation and build upon community collaboration in a short period of time. Academic settings, such as conferences, have been noted to utilise the game jam format for building upon hypotheses and improve professional expertise (Decker, Eiselt and Voll, 2015). Game jams within academic settings typically revolve thematically around domain-specific subjects, most notably in HCI or public health, and "replace abstract and arbitrary design themes with context based research" (Goddard, Byrne and Mueller, 2015).

Demonstrable results of game jams used in conference settings include *Game Jam [4Research]* (*GJ4R*), a regular feature as part of the CHI Conference. *GJ4R* was created to support "the exploration of problem space and solutions for interaction design" (Goddard, Byrne and Mueller, 2015). It is also worth mentioning that the results of *GJ4R* include numerous publications within the field of HCI (Goddard, Byrne and Mueller, 2015), highlighting their potential in delivering high research impact opportunities. While an isolated example is provided, the use of game jam formats is becoming increasingly popular within the academic environment (Decker, Eiselt and Voll, 2015), promoting skills development, knowledge transfer, and research progression among participants.

Game jams have also exceeded their traditional format as simply an environment for technological enquiry and rapid development. The connectedness between organisations and early-stage professionals is notable in game jam settings. Businesses have capitalised on the opportunities presented by game jams to test products and services with a controlled target group (Decker, Eiselt and Voll, 2015). Conversely, students have been known to capitalise on larger events as a means of sourcing and securing work (Decker, Eiselt and Voll, 2015). Such use of game jams highlights the multidimensional motivations for hosting and participating, from consumer testing to career progression.

Cook et al. (2015) presents a set of considerations for creating a game jam within the academic sphere (Figure 2). While this framework is more concerned with the creation of game jams at academic conferences, there are a few transferable recommendations presented. This includes optional participation, goal-oriented development, and the use of "time frames" as opposed to "deadlines" (Cook et al., 2015). However, when discussing open collaboration, it is suggested that "Team formation should be free-form, with no set size or structure to group demographics" (Cook et al., 2015). The authors contend that by limiting team sizes, participants become more conscious of their skills and abilities that can help them to define achievable goals. Arguably, smaller team sizes can amplify the necessity to scope and design achievable outcomes within the allotted time, which allows for more focused, refined, and specialised prototypes to be developed.

Figure 2: Recommendations for hosting an academic game jam (Cook et al., 2015)

Additionally, the recommendations suggest that game jams should provide "an open space to allow a variety of working arrangements among contributors" (Cook et al., 2015). As these recommendations were made with conference environments in mind, the physical presence of participants has to align with the space available. While the authors appreciate the recommendations for physical space, they argue that the considerations should extend to game jams that take place in the online space, such as *LD*. This brings into question the intended format of delivery and the rationale of the game jam itself. The authors agree that physical presence and space can create a more collaborative working environment (Cook et al., 2015) and foster closer partnerships between participants. However, physical game jams are limited to the environment in which they are hosted such as venue hiring and available facilities, physical attendance of participants, and costing.

Conversely, online game jams remove these considerations by encouraging people to work remotely, where their participation is defined by the facilities available to them. Contrasting to hosting physical game jams, the communication and "human factor" may be compromised, as participants are unlikely to be in shared space and, thus, removing the community spirit of the game jam. There are benefits and limitations to each format; therefore, the format of delivery depends on the overall purpose of the game jam: whether it intends to foster communities to collaborate, or whether it requires expertise at minimal cost.

3. Methods

3.1 noPILLS Game Jam

Certain academic and research needs are being addressed through technologically-driven approaches (Decker, Eiselt and Voll, 2015), and the use of game jams provides a less resource-intensive method to approaching these challenges (Cook et al., 2015). Glasgow Caledonian University (GCU) aimed to provide an example of a serious game jam as part of *noPILLS* (Adamczak, 2015), a pan-European research initiative aimed to address water health and pollution in public and private reservoirs. GCU hosted the *noPILLS* Jam (*NPJ*), a 48-hour game jam that accommodated for students and professionals from Scotland to develop prototypical evidence on potential approaches to addressing water pollution. Unlike previous game jams hosted by GCU, the *NPJ* attracted significantly fewer participants. The number of participants can range anywhere between 30 people to 150 people. In the case of *noPILLS*, only 10 people took part. The organisers attributed the low attendance to the complex theme of the jam.

Participants were briefed about the *noPILLS* project and asked to develop games that would help disseminate the findings from the project to members of the public. The *NPJ* produced a total of three games, all of which were selected to be pitched to the research partners of *noPILLS* in Zurich, Switzerland. The games addressed the topic of water pollution from different perspectives and targeted different audiences from children to adults. They were all considered as successful demonstrations of the potential that serious game jams can offer in developing rapid prototypical evidence for research initiatives.

The game jam format was chosen to satisfy interest within the *noPILLS* research group on the potential use of digital media to address the concerns of public and environmental health. It emerged that key policy stakeholders within *noPILLS* identified areas of similarity within the game jam process and the development of policy; the ideas conceived and developed upon within the game jam were remarked to have been similar thoughts as part of discussions on policy. The opportunity to take key queries from policy stakeholders to the public bodies through the medium of games was seen as a key reason in deciding to host a game jam.

4. Results

Each of the submitted games focused on an alternative aspect of *noPILLS*, targeting different demographics and producing prototypes that, mechanically, function different. The outcomes of the games are expected be used for future research opportunities in relation to social engagement through serious games (Adamczak, 2015).

4.1 Sewer Sweeper

Sewer Sweeper (Figure 3) focuses on water filtration from a first-person perspective. Players shoot at particles representative of micropollutant elements as they move continuously through the pipe environment. Players can choose from a variety of areas reflective of rural and urban communities. Each area represents different challenges reflective of the real-world environments, such as an over-exposure to certain micropollutants in rural reservoirs. The player learns about these micropollutants through a quiz-like format as they progress through the level. Scores are based on the player's ability to shoot and remove the particles, and answer questions on the subject area, and are displayed through a leader-board system.

Figure 3: Sewer Sweeper.

The learning element of *Sewer Sweeper* exists within the players' understanding of the varying sources of pollution portrayed in the game. Commonly-known elements such as antibiotics, caffeine, and detergents act as enemies to the player: if these elements were to make it past the player's field of view, a bar corresponding to that element is incremented, thus making any future encounters with that element more dangerous. Players lose if one element's bar is filled as a result of being unable to remove the elements from the environment. This creates an urgency to remove as much as the player possibly can based on their skill level, and is reflective of the urgency to removing these elements from real-world water supplies. While no formal research has been conducted with *Sewer Sweeper* to identify the validity of its learning content, this is an assumed research outcome that the report of *noPILLS* makes reference to (Adamczak, 2015).

4.2 Polluted

In *Polluted* (Figure 4), players learn that the fish have been exposed to pollution within the waters caused by sewage caused by irresponsible disposal methods of humans. Players must manoeuvre a small fish through the treacherous waters, taking shelter in seaweed to avoid being attacked. They must also avoid capsules within the water, which causes certain camera effects and control manipulation to make the player's objectives more difficult.

Figure 4: *Polluted*.

Polluted chooses to focus on the dangers and effects on marine life and educate players through a mixture of narratological and ludological stimulus. The use of stealth-based mechanics at the disposal of the player, and the omission of any combative mechanics available, projects the sense of fragility that the player should experience. This resembles the dangerous, changing climate of freshwater reservoirs and the development of fish acting aggressively towards each other. A narrative is also presented to the player from the perspective of the controlled fish, in which it becomes aware of the change in its home and [other fish] over time as a result of the pollution. The narrative intends to contextualise the events and allow players to understand the cause-and-effect realities of pollution on a sympathetic level.

While *Polluted* only highlights a minimal section of the ecosystem without much reference to the wider impact the game's events may have, it does provide a more focused representation of the dangers presented by the *noPILLS* research. It also presents an entry route to the wider ecological debate from the perspective of water health: rather than aiming to educate on the full extent of challenges faced, *Polluted* incrementally introduces players to the ecological and environmental debates on public health and pollution. Such as with *Sewer Sweeper*, formal research on the effectiveness of this development choice is assumed as part of the outcomes from *noPILLS* (Adamczak, 2015).

4.3 Purity

Purity (Figure 5) is a simulation-based management tool that attempts to educate publics and professionals in the effects of pharmaceutical pollution on the wider environment. Players assume the management of a water treatment plant, reflective of some research partners of *noPILLS*. *Purity* presents a scenario reflective of the treatment process of sewage, and challenges players to identify certain substances in order to conduct appropriate actions to reduce the overall environmental impact of the waters. The actions focus in on specific filtration methods, such as carbon filtration and UV treatment. This, in turn, expects players to learn about the systems in place for sewage treatment, and react to situation through awareness and applied knowledge.

Figure 5: *Purity*.

One of the main challenges faced with *Purity* was the level of fidelity conveyed through the game. *Purity* approaches the development of a serious game scientifically, maintaining high fidelity of content and processes that reflect the real-world stages of water treatment. The level of fidelity posed numerous challenges in respect to engaging players in the content without feeling overwhelmed or unresponsive to the game's systems. It is understood that closer resemblances to realism results in a higher likeliness of transferring learning than that of an abstract nature (Stone, 2008; Ulicsak and Wright, 2010). However, a balance between fidelity and play must be considered in order to avoid the game achieving the "chocolate-covered broccoli" designation (Bruckman, 1999; Habgood, 2007). For *Purity*, an emphasis was placed on the user interface to counteract the heavy-simulative nature of the game. It was also intended to portray a welcoming feeling and promote intrinsic interactivity with the game. This, in turn, makes it more likely for players to engage with the game's content as they spend less time learning how to navigate menus and control schemes due to their familiarity (Ulicsak and Wright, 2010).

Purity presents a predictive and simulative opportunity within the research of water health and environmental sustainability. It reflects the systems in real-world environments, and as such can be used as a means of presenting happenstances. This would be beneficial to health organisations and water treatment laboratories that can simulate potential scenarios and methods of intervention before these events happen in real-world environments. *Purity* allows for the forecasting of such events and preparations to be installed in order to minimise the resultant impact on public and environmental health. As a result, *Purity* can also be considered a resource-saving tool for organisations that world benefit from this opportunity.

5. Discussion

5.1 Developed Games

The *NPJ* can be considered a successful application of the game jam format to prompt research enquiry as part of a wider project. The resultant prototypes highlight research potential in three different spaces of *noPILLS* that may otherwise have not been prompted in more traditional methods of enquiry. For three diverse prototypes to be created within a controlled time frame and intense environment, the *NPJ* aims to validate further the potential application of game jams for prompting or supporting wider research opportunities.

These prototypes, and *noPILLS* as a whole, have informed the development of a research project which aims to identify serious games as an effective method for engaging publics in social policy. The research project will analyse the benefits and limitations from *Sewer Sweeper*, *Polluted* and *Purity* through public opinions from demonstration events. The prototypes will also inform the development of *Project:Filter*, a game aimed to generate interest in water health in adolescents (Figure 6). Experiments in data collection based on participant opinions, learning and retention of knowledge, and attitudinal indicators are ongoing, and formal data will emerge throughout the research project.
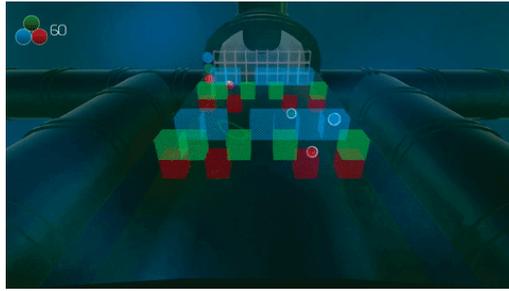
Figure 6: Project:Filter.

5.2 The Game Jam Format

It must be stated that more research in the format of game jams and their impact on output must be continued. Due to the diverse intentions of game jams – whether to adhere to the traditional format of intense problem-solving for wider application, or for developing commercially-viable products – it is fair to assume that the determinant successes of game jams for serious purposes must be considered. The authors did not find supporting, comparative research between game jam formats and their suitability for application in the field of research. Therefore, the authors propose a matrix of game jam formats (Figure 7) which aims to classify game jams based on available resourcing.

Figure 7: Game Jam Format Matrix.

The matrix separates game jams by both the participating community size and the available operational budget. Each game jam format operates differently depending on the resources at the disposal of the organisers, and therefore has a wider impact on the potential outcomes from each event. With the benefits and limitations presented by each format, it relies on prioritising these attributes and accepting the conditions of community size and budget in order to achieve the optimal output.

Well-established locational game jams, such as the *GGJ*, benefit from large participating numbers, resulting in a plethora of ideas to consider for research opportunities. This may result in the time-consuming activity of manually finding appropriate ideas to take forward from the collection of submissions, but systems can be put in place to minimise the time taken, such as a tag-based input of mechanics, content, and intention (for example, "commercial" or "research") when submitting. The locational format indicates a physically-hosted event, usually referred to as "sites" that accommodates participants. However, established game jams such as *GGJ* have a logistical and operational panel, and therefore externals to the organisation of such an event may have little thematic influence. Adapting wider research opportunities to the themes of well-established events may provide challenges in establishing interconnectedness and relevance to an existing research, and as such may not be the most appropriate format to choose from.

An online game jam similar to *LD* boasts a similar large community to the *GGJ* with similar accompanying benefits. However, the online nature of these events makes it more difficult to police contributions. Online formats also do not receive the same community spirit as locational game jams as the communal presence takes place digitally, removing the human element. The benefit of online game jams relates to their less-

resource-intensive nature in comparison to physical game jam formats, where organisers can simply provide a portal of information (such as a social media account or web page) as opposed to a venue, equipment, or hospitality.

The local or organisational hack – conceived as the traditional format, as exhibited by *IGJ0* – benefits from low up-front costs with potential for a high-reward from the output. Organisations are more likely to have thematic influence, and therefore more control over how a game jam can relate to wider opportunities. Successful, consistent events may result in fostering a community, but this may risk the anonymity and control over the event depending on conditions of sponsorships or partnering communities). Additionally, a smaller community may produce fewer prototypes as a larger community, and as a result organisations may have fewer ideas to choose from.

Incentivised development as an outcome for game jams, shown in the *NPJ*, infer similar low up-front costs as local hacks as a means to "trial" ideas before more concentrated development can begin (thus introducing risk mitigation to game development through the environmental format.) While the *NPJ* suffered from similar "small community" issues identified within the organisational hack format, stakeholders had more thematic influence over the developments of prototypes.

It is important to distinguish the varying attributes, benefits and limitations of each game jam format, as to simply state the use of game jams as a valid approach to research would disregard the diverse formats of game jams. The *NPJ*, for example, was a much more controllable format, in comparison to *LD*, for a research-driven hack event: the budget available allowed for a physical development space – generating a community spirit – and an opportunity to incentivise development, with the prospect of pitching successful ideas to research stakeholders and secure funding. However, the smaller participating community compared to *LD* meant that only a few ideas were developed; a larger community may have presented more research opportunities to consider.

While not a conclusive statement, the game jam format matrix aims to establish future work in understanding the relationship between research outcome generation and the adopted game jam format. This is expected to assist organisers and stakeholders with a rationale of which game jam format to adhere to in order to achieve an optimal output for wider application.

6. Conclusion

This paper highlights the importance of game jams as a tool for researchers to explore new ways in which to solve difficult problems. The popularity of game jams continues to rise especially when appropriated to new contexts i.e. in research and education. The collaborative nature of game jams affords people the opportunity to work on interdisciplinary projects and rapidly prototype ideas thereby making it a valid design research method. Participatory game design is an emerging method in the game development area, particularly in the area of serious games, as expertise from context-specific domains becomes more desirable. A game jam facilitates from rapid development based on multiple disciplinary expertise to enquire about possibilities and potentials in utilising serious games for research.

While there are a number of serious game jam examples, there is not an extensive literature highlighting the process of creating a game jam for research purposes. This paper has aimed to open up the research of game jams for research by providing an example, the *NPJ*, and the impact that the resultant games have had in defining potential research outcomes. From conducting the *NPJ*, the authors present three considerations for the structure of future serious game jams for research purposes.

Firstly, the *NPJ* benefitted from having a team of researchers from *noPILLS* on-site with the developers. This collaborative effort allowed for expertise to be divided and mixed between disciplines: developers could draw upon the knowledge of the researchers to design and develop prototypes, while researchers had their work translated through the medium of games as a result of effective communication. Having key stakeholders from *noPILLS* also available may have generated a different breadth of prototypes due to the addition of new expertise, perspective, and agenda. The authors recommend consideration of participating parties and the potential impact that this may have on research outcomes.

Secondly, more formalised game jams may not result in the same participation numbers as casual or well-established game jams. The formal research nature of the *NPJ* could have been a contributory factor to the low turnout. While this is inconclusive, it makes the relationship between game jam structure and research outcomes more relevant, where a smaller event may be more appropriate such as the case for the *NPJ*.

Finally, the direction of game development was very open due to the broad nature of the research project. This was appropriate for *noPILLS* as the *NPJ* was designed as an enquiry into potential serious game usage for the wider project. However, more specific research projects would require teams to follow a creative brief of sorts. With a more formalised development structure, the elements of what differentiates hack events from traditional development environments become blurred. As such, this adds necessity to understanding game jam structures for research purposes.

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