Building Digital Tools Assisting Escape Room Maintainers
Survey and Analysis Stage, COM3610

Simon Fish | Supervisor: Andrew Stratton
This report is submitted in partial fulfilment of the requirement for
the degree of Computer Science with a Year in Industry by Simon Fish.

2020-04-13

Signed Declaration

All sentences or passages quoted in this report from other people's work have been specifically acknowledged by clear cross-referencing to author, work and page(s). Any illustrations that are not the work of the author of this report have been used with the explicit permission of the originator and are specifically acknowledged. I understand that failure to do this amounts to plagiarism and will be considered grounds for failure in this project and the degree examination as a whole.

Simon Fish

Abstract

Escape rooms are physical, interactive experiences in which a group of participants must solve puzzles to escape a locked room, solve a mystery, or otherwise meet some goal in a particular timespan. This report uses various studies into applications of escape rooms to discuss the priorities of well-made escape games, particularly with regards to the inclusion of technology. It also marks my current progress in research into my dissertation topic as expressed in the title. It focuses on the difficulties in applying technology in escape rooms and priorities that should be held in order to mitigate these. On this basis, it serves to document universal requirements to bear in mind when developing hardware or software for escape rooms.

Contents

Chapter 1

Introduction

The aim of this project is to build tested tools to meet the needs of escape room maintainers. Research will be focused towards exploring the needs of escape room maintainers, such that a product can be designed and built to target some subset of these needs. These needs may be related to various issues - such as making sure a timer is visible to the group, or to processes that currently take more time than necessary, such as posting photos of teams to social media (Woff 2019).

In order to guide the focus of my project, I will use this paper to identify and discuss the features of escape rooms and their implementation across existing publications. I intend to do so guided by my chosen research questions. This is expected to reveal requirements for developing tools for escape room maintainers across industries.

Research Questions

I have identified two research questions, which this stage of the project will be focused towards answering:

RQ1: What has been reported about concepts used in escape rooms applied in different environments?
RQ2: Based on this, what can we establish as the requirements for escape games, independent of their environment?

Chapter 2

Background and Motivation

Escape rooms are physical, interactive experiences in which a group of participants must solve puzzles to escape a locked room, solve a mystery, or otherwise meet some goal in a particular timespan. They are a phenomenon that has existed since around 2007 (Nicholson 2015), and are a growing industry. Escape rooms are run both by enthusiasts as solo ventures, and as franchises across the country. Nicholson (2015) documents escape rooms as the culmination of a variety of media. Nicholson identifies puzzle hunts as team-based problem-solving challenges, which, with treasure hunts, appears most similar to escape rooms. Various others have lent features to escape rooms, such as immersion in a story as the "hero", which DuPlessie (2013) reports as being something participants enjoy. This is embodied by live-action roleplaying, another inspiration for the genre (Nicholson 2015). Nicholson presents the precursors to escape rooms in further depth in his paper - Figure 2.1 summarises these.

Escape rooms have grown popular in many locations across the world as a recreational activity (Nicholson 2015; Stasiak 2016), even serving as a tourist attraction (Dilek and Kulakoglu Dilek 2018). Nicholson reports that the *Real Escape Game* by SCRAP was the earliest well-documented activity branded as such. SCRAP has gone on to develop escape rooms at a much larger scale than the typical escape room, which serves teams of an average size of 4.58 people (Nicholson 2015).

My goal in writing this literature survey is to understand not only the needs of the commercial escape room industry, but also the differing requirements for the application of escape rooms in education and corporate contexts. The major difference between these contexts is that the commercial escape room industry is most regularly founded on permanent fixtures, and educational escape rooms are often applied in a classroom environment, which can imply more limited space and the need to tear down the room after it has been completed. These different environments dictate some differences between escape room experiences. However, as I intend to show in the literature survey, inspiration can be taken from both contrasting environments and applied universally.

Figure 2.1: Nicholson (2019) presents the precursors to, and inspirations for, the escape room phenomenon in this diagram. Adapted with permission from Nicholson, Scott. 2015. "Peeking Behind the Locked Door: A Survey of Escape Room Facilities." *White paper available online at http://scottnicholson.com/pubs/erfacwhite.pdf.*

Chapter 3

Literature Survey

Escape room maintainers are able to apply technology to varying degrees. On the outside of the escape room experience, maintainers implement leaderboards, share team photos to social media, and interact with the team via a screen or handheld transceiver in the room. Inside the room, entire puzzles can be based on technology, if the owner has the necessary expertise. Some more unique applications within the room are also possible, such as using a hidden camera to take a photo of the team, apply filters, and display the photo among works of art as demonstrated in The Gallery[1], which I visited in July 2019. However, there is a general aversion to the use of technology in escape rooms, for a variety of reasons. Woff (2019) suggests that the time investment, reliability, and necessary expertise are some of the greatest contributing factors. DuPlessie (2013) approaches this from the perspective of immersion - with 70% of escape room games being purely physical activities (Nicholson 2015), DuPlessie recommends movement away from what he calls the "glowing rectangles" as our medium of choice.

The increasing application of IT in education means that computers are often part of the school environment, and can be used as a tool when building an escape room experience for educational purposes. Several studies cover the use of escape rooms as a means for education (López 2019; Rouse 2017; Peleg et al. 2019; Beguin et al. 2019). Rouse (2017) applied technology to an escape room in the classroom using a game loaded from a memory stick. This application seems understandable, as Rouse's audience was likely to have some basic level of expertise in, and enthusiasm for, handling computers as part of the digital native generation. However, in practice, it brings to mind the image of a small group of people crowding around a screen. Woff (2019) warns against situations like this, saying that visibility of the puzzle to the entire team should be a priority.

However, poor implementation does not mean technology should not be excluded from escape room environments outright. Instead, I feel technology has the potential to inspire change in escape rooms. Escape rooms and technology are inherently linked - digital escape-the-room games such as *Myst* precede and inspire physical escape rooms (Nicholson 2015). These forms of escape room evade a shortfall that is one of physical escape room maintainers' greatest anathemas - resetting these rooms is as simple as resetting the game. Whether this is done by restarting an attempt, restarting the game, or removing save files and starting over, it is often trivial compared to how long it takes to reset escape rooms. Woff (2019) suggests that resetting rooms can often take as long as 15 minutes, and that it is something escape room maintainers seek to optimise; the shorter a reset takes, the more time is available to welcome customers.

Commercial escape rooms are often permanent fixtures. This means that more immersive environments and more complex physical puzzles can be built. However, puzzles of a physical nature usually need to be reset by the room owner back to their original state, so that more than one group can attend a room in the same day. Contrary to this, escape rooms built in a classroom environment are usually of a temporary nature, and may even try to allow for multiple groups to attempt the room at once, at the cost of immersion and interactivity. A study by López (2019) organised its puzzles in a manner whereby puzzles could be completed in any order, allowing multiple groups to attend the room at once. One example puzzle given in the study was an exercise likely done on paper - exercises in this form make resets trivial, as a fresh worksheet is all that is necessary, but they also demonstrate the lack of immersion. Commercial escape rooms regularly employ more physical interaction - 78% of escape rooms employ

---

[1]https://escapist.nl/en/

a search for physical objects as part of the experience (Nicholson 2015). Some varieties of commercial escape room visit the other end of this spectrum, such as those developed by Tuzak, an Istanbul company developing portable escape games (Gündüz 2018). Portable or temporary escape games often trade immersion for greater logical challenge.

Application of technology in escape rooms comes with some uncertainty, and a break in the flow of the escape room experience can shatter participants' immersion and lead to negative reviews (Woff 2019). This also creates some difficulty when it comes to visibility - unless monitors are suitably placed and large enough to be viewed by a full party, the whole team may not be able to interface with a puzzle that applies technology. This is particularly an issue if a single typical workstation is set up - Nicholson (2015) warns of the danger of removing just one player from the "mental space" of the team.

Woff (2019) theorises that VR escape rooms such as EXIT VR[2] may be the next stage for the industry, which allow immersive rooms to be created while effectively eliminating the issue of resetting the room as above. This would bring the escape room cycle full circle, reincarnating the modern wave of physical escape rooms in the digital form that inspired them.

While the escape room industry cautiously explores the "glowing rectangles" DuPlessie (2013) warns against, the video games industry sometimes takes small strides to recede from them. This has resulted in concepts that escape rooms, and interactive experiences of all kinds, can learn from. *Keep Talking and Nobody Explodes*[3] focuses on asynchronous gameplay, in which one player must defuse a bomb while the others guide them using the bomb's manual[4]. Conceptually, the game shares fundamentals with escape rooms, but what is of most importance here is that the foremost task in the game is communication. Escape rooms already apply asynchronous gameplay - The Lockup Escape Rooms' *Meltdown* (Woff 2019) begins with most of the party in individual chambers, with the designated 'leader' communicating from outside - but *Keep Talking and Nobody Explodes* demonstrates that with technology, it is possible in almost any location. *1-2-Switch*[5] similarly pulls away from the screen, with the majority of its minigames relying on what is done physically with the Joy-Con controller and instructing players to face their opponent directly. It is an effective example of how to apply technology in a way that does not lock singular players into staring at a screen.

In summary, technology brings a variety of benefits, from quick resets when used as part of a puzzle to interesting and reactive ideas that may not otherwise be possible. Many ideas and inspirations have been discussed here. However, care must be taken to ensure that if the implementation separates one player from the group, it is applied in an engaging manner. Escape room maintainers value reliability, with negative reviews being the consequence for ill implementation (Woff 2019). The strength of escape rooms as an educational tool has also been demonstrated here, which is worth consideration when building for the escape room industry.

Keywords

I identified the following keywords for use in my search. The search was conducted using the Google Scholar search engine.

- escape room / puzzle hunt
- owner / host
- implementation
- software
- virtual reality
- education / classroom

This led to the following searches.

- escape room owner
- escape room host
- escape room software
- escape room education

---

[2]https://exit-vr.de/en/
[3]https://keeptalkinggame.com/
[4]https://bombmanual.com
[5]https://www.nintendo.co.uk/Games/Nintendo-Switch/1-2-Switch-1173186.html

- escape room classroom
- virtual reality escape room
- portable escape room

Additional searches were made based on discoveries such as escapED (Clarke et al. 2016) and Breakout EDU ("Breakout Edu," n.d.) to see where they had been applied.

Chapter 4

Requirements and Analysis

The objective of the project was to build a tool for the escape room community. The exact form in which this would come was to be dictated by the nature of the problem - if the scenario called for a tool that would be active inside escape rooms themselves, it would have been more likely to be hardware. At the initial stage, this was the intent - a set of networked microcontrollers/SoCs that would unite to track the escape room experience - but this was abandoned. The idea of building an escape room, even in the form of a prototype, was out of scope. Additionally, Woff (2019) warned that digital uptake in traditional escape rooms may be middling due to the inherent risk and time involvement, as discussed in the literature survey.

I surveyed the escape room community on Facebook to determine a firmer course of action, taking a selection of options as discussed with an escape room owner (Woff 2019) for further feedback. The Facebook group created by Nicholson (2015) was chosen to be surveyed. From the seven responses received, the following conclusions were drawn:

- The majority of the group already shares photos online, but those that do not are all interested by the prospect of it
- Memberships, in-character communications, advertisement among other escape rooms, and participant metrics are all of interest
- Memberships are agreed upon by those interested as something that should not be done without the involvement of technology

I was able to elicit a direction from these conclusions - the idea of a social network shared by escape room maintainers and enthusiasts allowed me to potentially target several of these factors at once. In particular, the purpose of this social network would be to allow escape rooms to advertise among others of their ilk and share photos. I concluded my analysis of the results by setting a goal statement.

Goal Statement

To design and build a system that:

- allows escape room owners to share photos with their community
- allows escape room owners to advertise among other escape rooms
- allows escape room enthusiasts to discover new escape rooms to tackle
- allows escape room enthusiasts to track which escape rooms they have cleared

---

With these as an initial guide, I began to set requirements using the MSCW system, aiming to complete all defined as **Must**- and **Should**-Have by the end of the project. Though these were not formally defined and did not dictate the order in which I completed tasks, I thought on what I had learned during my year in industry - while haste was of the essence, I made strides to emulate the software development process as I had seen it firsthand.

Stories were written with parts of the goal statement ('epics') in mind and estimated according to their complexity using a modified Fibonacci scale. In agile software development, complexity estimates are

preferred to time estimates as the former are easier to settle upon (Karlesky and Voord 2008). Stories with estimates any greater than 13 would need to be broken down into smaller stories. This was a principle I kept in mind from my year in industry. Atlassian suggests a differing scale and limit, but the basic principle of keeping stories small and manageable is there. Velocity is of the essence, and smaller tickets assist with that.

Another factor I kept in mind when creating stories was keeping them open. Stories, as often as possible, would need to describe what the user would wish to achieve, as opposed to what the developer working on them should aim to do. Framing stories from this perspective allowed me to keep their implementation open to change and interpretation.

My approach was not reminiscent of the Scrum process used in my team last year. Instead, I elected to move towards a Kanban approach. Kanban is employed when more flexibility is desired. It prioritises throughput and encourages a "culture of 'done'" by enforcing work-in-progress limits. With this in mind, it would be difficult to set more than two development milestones. Treating each MSCW category as an epic and taking the amount of time necessary for work on this report and my other modules into account, I aimed to work on the project for a month, devoting about two weeks to each milestone.

I figured that each milestone would take a similar amount of time - while Rails' built-in generators would likely ease the burden of scaffolding the initial functionality, setting that groundwork in the right way would take slow and careful decisions. Scaffolds would dictate the flow of the rest of the project to a degree.

Forgoing the later milestones, and many ideas that might even give Blacklight commercial viability with them, was a difficult decision to make. However, I am happy with the base functionality and usability that came to be.

- **Dev commenced** Mar 12th
- **Must done** Mar 26th (actual 24th)
- **Should done** Apr 16th (actual 13th)

Chapter 5

Progress

I have been able to make good progress in defining my scope this semester. The most important thing I have had to do is to get in contact with the escape room community - I have been able to reach out to all of Sheffield's escape rooms, though only one has returned any interest in supporting the project. This was The Lockup Escape Rooms in Sheffield.

I got in contact early in November, which was a busy time for all rooms. In initial communications with The Lockup, Liam offered a free attempt at one of the two rooms offered pro bono. I took up this offer on the 29th November with a group of friends, tackling the *Meltdown* escape room and its hard mode option in 53 minutes and 57 seconds. The experience was enjoyable for all, and I was interested to see some science applied within the room - one of the puzzles relied on mixing chemicals and using the colours of the resultant reactions to solve the next puzzle.

Before this, I met with Liam on the 20th November to discuss the challenges he faces as an escape room owner, and his philosophy in developing the rooms he offers at The Lockup. Engagement, visibility and breakability all inspire his approach: the entire party must be able to interact with, and be engaged by, puzzles in the room, and the puzzles should not take long to reset to their initial state for the next party that attends the escape room (Woff 2019). Liam and I discussed some areas that could be targeted, which inspired a survey I sent to the Facebook group created by Nicholson (2015).

Nicholson runs a Facebook group[1] for escape room enthusiasts, encompassing both maintainers and participants, to which I sought and gained access as part of my work. The majority of posts, at the time of writing, seem to be from enthusiasts who report back from rooms they have attended, though I have seen posts about types of puzzles that can be implemented. I intend to survey this group, as it appears to be a central hub for what may be a sparse online community.

Though I have not yet locked in my approach, I have been learning to develop for the ESP32 microcontroller and the unPhone platform (Cunningham 2019). This provides a strong framework for IoT development at a low cost and may be an outlet to explore in the development of my artifact. My solution may take the form of a web application - a MVC or static site genneration/progressive web app approach may be used depending on the scope of the data stored serverside.

---

[1] https://www.facebook.com/groups/608883549212939/

Chapter 6

Conclusions and Project Plan

It is difficult for me to provide a detailed plan at this stage, since I have not been able to calibrate the scope of my project in time for submission of the literature review. However, I should be able to define this once I understand from my survey what the industry wants. I intend to aim for completion of the project in mid-April, which will give me two months of float to work with. Independent of what I choose to build, I intend to:

- Break the task down into epics and tickets, as explained by Drumond (n.d.).
- Refine the tickets. The goal is to be able to pick up any given ticket and to have left myself enough information that I could comfortably progress with it.
- Estimate the tickets using story points. Of course, these would be subjective estimates, but I have no doubt that they will assist in helping me to prioritise and schedule work. They will give me confidence in being able to predict how much I should be able to complete by the end of the project.
- Begin work, focusing in particular towards research into unknown areas. Should I choose to use a tool that I don't yet have full knowledge of, I will first make sure that my knowledge and capabilities in using it are adequate.

In writing this literature survey, I have extended my awareness of both the strengths and difficulties in implementing technology in escape rooms. I will need to bear this in mind strongly when development of my solution begins. I have also been shown the value of escape room technology in other forms than the typical commercial application - a tool that is as effective in pedagogy as it is in escape rooms is of the essence.

Bibliography

Beguin, Erwan, Solal Besnard, Adrien Cros, Barbara Joannes, Ombeline Leclerc-Istria, Alexa Noel, Nicolas Roels, et al. 2019. "Computer-Security-Oriented Escape Room." *IEEE Security & Privacy* 17 (4): 78–83.

"Breakout Edu." n.d. *Breakout EDU*. https://www.breakoutedu.com/.

Clarke, Samantha, Sylvester Arnab, Helen Keegan, Luca Morini, and Oliver Wood. 2016. "EscapED: Adapting Live-Action, Interactive Games to Support Higher Education Teaching and Learning Practices." In *International Conference on Games and Learning Alliance*, 144–53. Springer.

Cunningham, Hamish. 2019. "The unPhone: An Esp32 with Sugar and a Cherry on Top for the Iot." *unPhone Yourself!* https://unphone.net/the-unphone/.

Dilek, Sebahattin Emre, and Nur Kulakoglu Dilek. 2018. "Real-Life Escape Rooms as a New Recreational Attraction: The Case of Turkey." *Anatolia* 29 (4): 495–506.

Drumond, Claire. n.d. "Scrum - What It Is, How It Works, and Why It's Awesome." *Atlassian*. https://www.atlassian.com/agile/scrum.

DuPlessie, Matthew. 2013. "Go Analogue." YouTube. July 11, 2013. https://youtu.be/tTcl5I0Wbzk?t=668.

Gündüz, Şafak. 2018. "Preventing Blue Ocean from Turning into Red Ocean: A Case Study of a Room Escape Game." *Journal of Human Sciences* 15 (1): 1–7.

Karlesky, Michael, and Mark Voord. 2008. "Agile Project Management," October.

López, Ángela Gómez. 2019. "The Use of Escape Rooms to Teach and Learn English at University." *Research, Technology and Best Practices in Education*, 94–102.

Nicholson, Scott. 2015. "Peeking Behind the Locked Door: A Survey of Escape Room Facilities." *White Paper Available Online at Http://Scottnicholson.com/Pubs/Erfacwhite.pdf.*

Peleg, Ran, Malka Yayon, Dvora Katchevich, Mor Moria-Shipony, and Ron Blonder. 2019. "A Lab-Based Chemical Escape Room: Educational, Mobile, and Fun!" *Journal of Chemical Education* 96 (5): 955–60.

Rouse, Wendy. 2017. "Lessons Learned While Escaping from a Zombie: Designing a Breakout Edu Game." *The History Teacher* 50 (4).

Stasiak, Andrzej. 2016. "Escape Rooms: A New Offer in the Recreation Sector in Poland." *Turyzm* 26 (1): 31–47.

Woff, Liam. 2019. Personal communication.