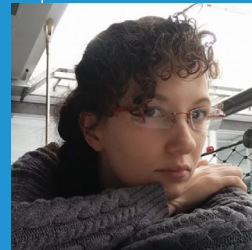


Escape with a Purpose

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Dr De Angeli has more than 10 years of experience designing games and interactive exhibitions for museums and other organisations in the USA and Europe. She is currently a Lecturer in the Department of Computer Science at the University of Bath and the Co-Director of Echo Games CIC, a community interest company developing 'seriously fun games' (echogames.co.uk). She completed her Doctorate at the Centre for Digital Entertainment at the University of Bath in the UK, with a thesis exploring the power of games to educate and share meaningful stories in museums. Her research is interdisciplinary and ranges from memory theories, art and social studies to human-computer-interaction and serious games. For example, she led the design and evaluation of two Agonistic games – the first official attempt to adapt Agonistic theory in games (see study *Unsettling play: Perceptions of agonistic games*). Agonism is a theory from memory studies that emphasises multiple perspectives in a conflict, highlighting the relationships between all agents involved, including bystanders and perpetrators.

ABSTRACT:

Escape rooms are increasingly popular all around the world. Due to their popularity, we are also seeing more variations in concept, form, and aim. For example, nowadays we can engage with physical, digital or mixed escape rooms. Escape rooms are also developed for a range of purposes beyond entertainment, including to broadcast a message, train, and/or exchange data. However, past research on escape rooms has focused mostly on analysing physical versions or on investigating if and how escape rooms can educate players. This paper aims to overcome these gaps by exploring how escape rooms (digital, physical or mixed) can be designed for a variety of purposes beyond entertainment. Hence, this paper offers two main contributions: a definition of escape rooms with a purpose and a framework that can be used to both design and analyse escape rooms with a purpose. The framework is initially implemented based on a literature review in the fields of serious games, escape rooms and puzzle design. Its efficacy is then tested through the analysis of three escape rooms with a purpose. Following this analysis, the framework is finalised to include the following key design elements: concept/idea; stakeholders (target players and others); purpose; goal/winning condition; equipment; theme; narrative (puzzle organisation and storytelling methods); puzzle design; and evaluation.

KEY WORDS:

design, education, escape room, game, location, methodology, narrative, serious games.

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Introduction

Escape rooms have a rich and diverse history, making their origins a topic of ongoing debate. Some attribute the genesis of escape rooms to television shows like *The Crystal Maze* (Heyworth et al., 1990-2020) and *The Adventure Game* (Dowling & Oliver, 1980-1986) (Suleski, 2024; Ascalon, 2021). These shows required participants to solve puzzles in order to exit a room, which aligns with the core concept of escape rooms. But escape rooms may also trace their roots back to point-and-click adventure games like *Behind Closed Doors* (Zenobi Software, 1988) and *True Dungeon* (“True Dungeon”, n.d.). Another precursor could be the computer game *Crimson Room* (Takagi, 2004), where players need to solve a series of puzzles to escape from a crimson-hued room (Suleski, 2024; Ascalon, 2021).

While opinions may vary, it is widely accepted that the first official escape room ran in Japan in 2007 (Corkill, 2009). This was a single-room escape game for teams of 5-6 players (“About SCRAP”, n.d.). Since then, escape rooms have become increasingly popular all around the world (Makri et al., 2021). Due to their popularity, we are also seeing more variations in concept and aim (Krekhov et al., 2021). For example, teachers started adapting escape rooms for educational purposes (von Kotzebue et al., 2022). The rise of digital technologies and the COVID-19 pandemic also accelerated the development of digital versions, which tend to be low-cost and flexible (Bezençon et al., 2023; Buchner et al., 2022; von Kotzebue et al., 2022). Thus, escape rooms can now take a variety of shapes and

forms. For instance, there are treasure hunts, live-action role-playing (Vidergor, 2021), VR experiences, board games, mobile and augmented reality versions (Krekhov et al., 2021).

Despite their popularity, research on escape rooms is still limited and is mostly focused on analysing physical versions or investigating their educational impact on players, while other platforms and purposes are often overlooked (Makri et al., 2021). Furthermore, while taxonomies for the design of escape rooms have been proposed, they tend to focus on recreational or generic escape rooms (Krekhov et al., 2021). This paper aims to overcome these gaps by exploring how escape rooms – whether digital, physical or mixed – can be designed for a variety of purposes beyond entertainment.

This paper explores the design of escape rooms with a purpose beyond entertainment, aiming to inform a framework for their development. Additionally, this framework can be utilized to evaluate and enhance existing games. After introducing the concept of escape rooms, this paper delves deeper into their purposes and design process. Drawing from a literature review in the fields of serious games, escape rooms, and puzzle design, we propose an initial framework for creating escape rooms with a purpose. Our goal is to bring together elements from various works within these fields, resulting in a new framework specifically designed to inform the creation of escape rooms with a purpose. To test this framework in practice and investigate its effectiveness, we used it to analyse the design of three escape rooms with a purpose. The insights gained from this analysis informed the final framework. In summary, this paper provides a set of design recommendations, laying a foundation for the development and critical analysis of escape rooms with a purpose.

Defining Escape Rooms

Escape rooms are commonly defined as games where players need to accomplish a goal (usually escaping from a room) within a specific time limit by discovering clues, solving puzzles, and completing a number of other tasks (Buchner et al., 2022; Nicholson, 2015; Vidergor, 2021; von Kotzebue et al., 2022). The time limit can vary but is often 45 or 60 minutes (De Souza & Kasseboehmer, 2022; Makri et al., 2021; Veldkamp et al., 2020). Furthermore, escape rooms also tend to have a theme (Bezençon et al., 2023) and to be team-based, meaning a group of people need to collaborate to complete the game on time (von Kotzebue et al., 2022). Usually, the game is played by groups of 3-6 players (Makri et al., 2021), although there are some cases of single-player games, but those are more common in digital versions (Krekhov et al., 2021).

While originally escape rooms were exclusively physical, nowadays they can also be digital or mixed. Indeed, the rise of digital technologies supported the rise of digital escape rooms. Some escape rooms are fully digital. For example, they can be web-based applications (Makri et al., 2021), Virtual or Augmented Reality applications, or online games (Krekhov et al., 2021). While fully digital versions may be preferred due to their lower cost and the fact that they can reach a wider audience (Makri et al., 2021), they do not necessarily exclude physical artefacts or environments (Huang et al., 2020). For example, Huang et al. (2020) explain how escape rooms can supplement physical environments with digital materials such as video, QR codes, and augmented reality.

Whether the escape rooms are physical, digital or mixed, players always must solve a variety of puzzles (Krekhov et al., 2021). According to Makri et al. (2021) we can call 'puzzles' any activity or challenge within an escape room. Usually, all puzzles need to be solved to complete the game (Krekhov et al., 2021). Those puzzles vary in form and style (Makri et al., 2021).

They also require a variety of skills to solve, which may be mental and in some cases, physical. While other games have puzzles, the peculiarity of escape rooms lies in their variety and the fact that they adhere to a coherent theme or narrative (Krekhov et al., 2021).

Given the great number and variety of escape rooms, Nicholson (2015) argues that the term *escape room* may not be appropriate anymore. He suggests alternatives such as *live-action adventures* (Nicholson, 2015). There are already cases in which the term 'escape room' is not used but rather 'exit games', 'breakout games' or 'unlock games' (Krekhov et al., 2021). While escaping a room is often part of the experience, we could argue whether this is a necessary feature at all. As a matter of fact, the 'room' aspect of the escape rooms is sometimes abandoned altogether. Sometimes, the 'escape' aspect is also abandoned as players need, for example, to break in rather than out (Veldkamp et al., 2020). Hence, we cannot help but agree with Nicholson (2015) in suggesting that other terms - such as 'live-action adventure' or 'unlock game' – could be better suited, although the name 'escape rooms' is very popular. Independently from the label we decide to use, this paper defines escape rooms as *games where players solve puzzles within a themed environment to achieve a goal*.

Escape with a Purpose

While escape rooms started as a form of entertainment (Nicholson, 2015), they have moved beyond the simple purpose of 'fun'. An in-depth analysis of the purposes of escape rooms does not currently exist. However, there have been attempts to categorise the purposes of serious games.

According to Abt (1987), who first used the term, '*serious games*' are games that not only entertain but also instruct and inform. Over time, this term has expanded to encompass a wide variety of game types, including edutainment, persuasive games, games for good, and games for change (Bogost, 2007; Djaouti et al., 2011b; Antle et al., 2014; Jarvin, 2015). Essentially, any game that goes beyond mere entertainment falls under the umbrella of serious games. Within the diverse and wide range of serious games, we encounter a spectrum. On one end, we have 'games for a purpose', which maintain aspects such as challenges and fun (Marsh, 2011). These games sit closer to the traditional gaming experience, emphasizing engagement and enjoyment. On the opposite side of the spectrum, we find environments with minimal gaming features (Marsh, 2011). Even when escape rooms fall into the 'serious' category, they still retain their gaming nature, making them a better fit within the games-for-a-purpose framework. Hence, in this paper we will use the term 'escape rooms with a purpose' to refer to *games developed with a purpose beyond entertainment where players solve puzzles within a themed environment to achieve a goal*.

Due to the variety of serious games, a few efforts have been carried out to classify them, including their purpose. For example, Djaouti et al. (2011a) first list six main objectives of serious games: to increase awareness, to stimulate reflection, to train, to inform, to teach and to influence. The same authors then group those six sub-categories into three main purposes:

- Games designed to broadcast a message, including messages that are educative, informative, persuasive and/or subjective.
- Games designed to train, for example, to improve cognitive or motor skills such as Exergames.
- Games designed to exchange data such as knowledge games where players provide, collect, process and/or analyse data (Schrier, 2016).

These main purposes can be applied to escape rooms with a purpose as well. For example, escape rooms have been used to broadcast a message, especially an educational one. Based on their experience with recreational versions, teachers started using escape rooms in their classrooms to support learning (Vidergor, 2021). This was the beginning of educational escape rooms. Recreational escape rooms and educational escape rooms have many similarities. In particular, they both have puzzles. However, recreational escape rooms usually target a broad audience, while educational escape rooms are often designed for specific target groups (Bezençon et al., 2023). Furthermore, recreational escape rooms primarily focus on entertainment purposes (Makri et al., 2021), while educational escape rooms take advantage of the collaborative nature of the game and the use of puzzles to achieve specific learning goals and objectives (Bezençon et al., 2023; Buchner et al., 2022). Indeed, puzzles have been successfully designed to test knowledge and stimulate active learning (Vidergor, 2021), although puzzles are not always effective in acquiring new knowledge (Veldkamp et al., 2020). In some cases, additional knowledge should be provided before and/or after the game to support learning (Veldkamp et al., 2020)

Due to the capacity of escape rooms to broadcast a message, they have been designed for different venues as well. For instance, escape rooms have been deployed in schools, where they engage and motivate students (Ang et al., 2020). A study even found that schoolchildren often prefer escape rooms to other types of digital games due to their collaborative nature (Vidergor, 2021). Museums have also started offering escape rooms. For example, the State Library of Western Australia offered *Memori*, to educate visitors about Western Australia's history ("*MEMORI: Live*", 2014).

Escape rooms have been used for training as well (Veldkamp et al., 2020), for example, to train designers (Li et al., 2018), healthcare professionals (Adams et al., 2018; Anderson et al., 2020; Brown et al., 2019), or computer scientists (Ho, 2018). Since players need to solve clues and puzzles, escape rooms can be used to stimulate problem-solving, critical thinking and creativity (Ang et al., 2020; Makri et al., 2021). Research has also found that digital escape rooms can help players express themselves and talk about difficult subjects like addictions (Bezençon et al., 2023). Furthermore, when escape rooms are team-based, they are quite successful in training teams by supporting collaborative work, communication, and social experiences (Nicholson, 2015). However, it is important to note that digital escape rooms are often single-player (Krekhov et al., 2021). In this case, the benefits of teamwork and collaborative play are removed. Even when digital escape rooms are designed for multiplayer, communication may be harder than with physical versions. As a result, physical versions tend to elicit more teamwork, communication, and social behaviour than digital ones (Ang et al., 2020).

As we will further discuss, escape rooms are sometimes evaluated. In those cases, data is collected from players. Escape rooms have been also used as a research tool, for example, to explore the dynamics and communication strategies within a team (Cohen et al., 2020). And more recently, escape rooms have been investigated as an evaluation tool for students' learning. In this case, players would provide data, for example, on how much they have learned about networking communications (Roig et al., 2023). However, to the best of this author's knowledge, there are no existing examples of escape rooms specifically designed to process and analyse data yet. Hence, escape rooms have been mainly designed to:

- broadcast a message (e.g. educate, inform, persuade, raise awareness);
- train (e.g. improve communication, problem-solving, and physical skills);
- exchange data (collect/provide data).

Design with a Purpose: An Initial Framework

Given the popularity of escape rooms, there have been efforts to investigate their design (Table 1). We conducted a literature review encompassing escape rooms, serious games, and puzzles to identify existing theories and patterns applicable to the development of escape rooms with a purpose. Google Scholar was used to find relevant academic publications on three topics:

- *Escape rooms*. Papers discussing different types and purposes of escape rooms, as well as their design. Some of the work found is broad, including any escape room (Krekhov et al., 2021), while other papers focus on educational escape rooms (e.g. Botturi & Babazadeh, 2020; Clarke et al., 2017).
- *Serious games*. Given the limited publications in the escape room field, we also explored papers discussing the design of serious games.
- *Puzzles*. Recognizing puzzles as a central feature in escape rooms, we also searched for papers addressing puzzle design and taxonomy for games.

We excluded papers lying outside these domains or those accessible only in abstract or presentation form. Ultimately, we reviewed 35 papers. Our focus was on identifying common design elements in serious games, particularly escape rooms, and categorizing puzzles. We used an excel sheet to record the frequency with which each element and puzzle were described. The elements and puzzles were listed in the first column, grouping similar elements together using colour coding, while the papers we reviewed were noted on the first row. In this section, we present the results of our review, highlighting key design elements for escape rooms with a purpose (Table 1, 3).

Table 1: Design Elements in Escape Rooms

	Krekhov et al., 2021	Botturi & Babazadeh, 2020	Clarke et al., 2017
Focus of the Analysis			
Recreational Escape Rooms	X		
Educational Escape Rooms		x	x
Design Elements			
Learning goals or objectives			x
Learning process		x	
Target group or participants	X		x
Equipment		x	x
Modalities and platform	X		
Theme	X		x
Narrative/story		x	x
Structure (Game/flow/narrative)		x	x
Puzzle organization	X		
Puzzle design	X	x	x
Hint system and failure handling	X		
Evaluation			x

Source: own processing

a) Purpose and Goal

Botturi and Babazadeh (2020) – one of the two models that focus on educational escape rooms – do not specifically list a learning purpose. The learning process includes how the learning is supposed to happen and the expected outcomes (Botturi & Babazadeh, 2020). Instead, Clarke et al.'s (2017) model starts from the learning goal or objectives.

It is important to note that 'learning goals' are independent of the goals to win the game (Veldkamp et al., 2020). In this paper, we refer to 'Goal' as the players' mission or winning condition. Such a goal is usually to (Doherty et al., 2023): escape from a locked environment, solve a mystery, accomplish a task.

Instead, the 'Purpose' refers to the non-ludic objective that designers set for players when developing a game. As Clarke et al. (2017) suggest, the developers of serious games should establish the purpose from the outset. This is because the purpose significantly influences the entire game design process (Murphree et al., 2020). For 'escape rooms with a purpose,' defining the non-ludic objective early on becomes even more critical. Typically, such a purpose falls into one or more of the following three categories: broadcast a message, train, exchange data. Those purposes are in addition to the ludic objective of an escape room. And balancing this entertaining side with the purpose can be a difficult task. For example, focusing on entertainment may hinder the purpose and vice-versa. And in some cases, players may feel overwhelmed (Buchner et al., 2022).

b) Target Audience

Neither Botturi and Babazadeh (2020) nor Clarke et al. (2017) include the target audience in their model. This is interesting as educational games are usually designed for a specific group of people (Bezençon et al., 2023). Only Krekhov et al. (2021) suggest that the design of escape rooms should take into consideration the target audience, including the team composition and size. For example, Veldkamp et al. (2020) suggest that groups of 4-6 players are ideal to support communication and social engagement. Makri et al. (2021) also note that diverse groups are the most successful and Nicholson (2015) observes how escape room players tend to be equally male and female. Identifying a target audience is also important in order to balance the game difficulty. If the target audience is too wide, for example, including players of different ages, it may be difficult to balance the game difficulty (Murphree et al., 2020; Nicholson, 2015).

Djaouti et al. (2011a) list three main types of target audiences for games with a purpose beyond entertainment: general public; professionals; and students. However, these categories may be too broad. For example, a game may be developed for the general public, it may target a specific sub-group, like children or elderly people. Similarly, the category 'students' may include adult students (e.g. University or College) as well as schoolchildren. When Ratan and Ritterfeld (2009) analysed serious games, they identified four groups, divided according to age: preschool and below; elementary school; middle school and high school; college, adult and senior. Ravyse et al. (2017) classified the target audience by their level of education: primary (elementary and middle) school; high (secondary) schools; undergraduate studies; and professional. When Nicholson (2015) surveys escape rooms, he identifies four main groups of players: families, younger players (under 21), adults over 21, and corporate clients.

While Nicholson (2015) classifies all minors within one target group, both Ratan and Ritterfeld (2009) and Ravyse et al. (2017) – who review specifically serious games – divide young players into multiple target groups. This makes sense as children learn differently according to their age (e.g. Kuhn & Pease, 2006). As for older players, Ratan and Ritterfeld (2009) argue that serious games developed for adults generally do not target a specific age range. Hence, all adults can be classified into one group. However, both Djaouti et al. (2011a) and Ravyse et al. (2017) consider 'professionals' as an independent target group.

Escape rooms with a purpose fall under the category of serious games. Consequently, it is crucial for developers to identify their target audience early in the design process (Bezençon et al., 2023). Drawing from previous audience classifications, we propose six distinct categories for escape rooms with a purpose:

- preschool children (up to 5 years old);
- schoolchildren (aged 6-12);
- teenagers or teens (aged 13-18);
- college/university students;
- professionals;
- general public (broad target audience).

While this classification may apply to any game, the target audience remains a crucial design element, particularly for serious games like escape rooms with a purpose. Each audience group brings unique perspectives that shape the design and purpose of escape rooms. Whether it is educational enrichment, team-building, or pure entertainment, understanding the intended audience is essential for creating engaging experiences that align with the game purpose.

c) Equipment, Modalities and Platform

Whether they are recreational or not, escape rooms have platforms or equipment that are physical, digital or both, like any other game (Table 1). For the sake of simplicity, in this paper, we will use the term 'equipment', merging 'modalities and platform' and 'equipment' into a unique category of design elements including:

Platform. The game may be developed for digital, physical or mixed platforms. For example, a game can be implemented exclusively for a computer platform as well as for a growing number of other digital platforms including PlayStation and Nintendo (Ratan & Ritterfeld, 2009).

Input modalities. The number and quality of game controllers have grown in recent years, mainly due to the increasing number of players across multiple platforms (Sinclair, 2023; Skalski et al., 2010). Hence, interaction modalities are not restricted to traditional keyboard/mouse and single-button joysticks anymore. There are also intangible interfaces involving movement tracking and eye tracking, as well as a variety of other sensors and game controllers (De Angeli et al., 2022; Laamarti et al., 2014; Murphy & Lefloic-Lebel, 2023). Furthermore, Cairns et al. (2014) identified three main modalities to interact specifically with mobile games: touch, tilt and slip. For example, players can tilt the device to engage with a game, touch the screen or slide a finger along the device. Other ways of interacting with mobile games have been also explored – including speech input (Azenkot & Lee, 2013) – and in some cases, the mobile device itself is used as a game controller or gamepad (e.g. Torok et al., 2017). Thus, we will categorize the interaction modalities as:

- traditional computer controls (keyboard/mouse);
- gaming controllers that are wired directly to a device or wireless (e.g. joystick, Xbox controller, Nintendo Wii Remote, Nintendo Switch). Gaming controls can also be tangible or intangible when sensors track gestures or eye movements;
- mobile interface, which includes any interaction involving a mobile device;
- tangible items or objects used in physical or mixed games.

Platform and interaction modality are key design elements for any game, but they become even more significant in serious games like escape rooms with a purpose. After all, the choice of platform and interaction mode influences the overall experience and engagement level in escape rooms. Developers of escape rooms must carefully choose

a specific platform and interaction mode based on both the intended purpose and target audience. For example, if developers want to link the game experience to a specific location, they might opt for a physical platform. This could involve creating an escape room within a physical space, such as a themed room or building. If instead the goal is to reach a wide audience, developers may choose a widely available platform and modality. For example, more households worldwide have access to computers than video game consoles (Alsop, 2022, 2023). Therefore, a digital escape room developed for computers, utilizing keyboard and mouse input, could be the most accessible solution for the general public

d) Theme

The 'theme' is the general setting of a game (Krekhov et al., 2021). A setting can be a period in time and/or a location/environment where the game is taking place. Such time and space can be historically accurate or completely imagined. These settings can range from historically accurate to completely imagined. While not all escape rooms feature a fully developed narrative, they all share a common characteristic: 'a themed environment'. The most popular escape room themes are historical, futuristic, fantasy, horror, scientific, military, steampunk, everyday life, seasonal, pop culture, and abstract (Nicholson, 2015).

In escape rooms, a theme can be influenced by the purpose and the narrative. In turn, the theme may influence aesthetics, sound design, puzzles, and narrative (Doherty et al., 2023; Krekhov et al., 2021). For example, if the game's purpose is to educate about a specific historical event, developers will likely evoke the look and feel of that particular period. Interestingly, Botturi and Babazadeh (2020) did not consider the theme a key design element of escape rooms. However, escape rooms, even when lacking context and narrative, still feature a themed environment. Nicholson (2015) categorized this as an 'abstract' type of theme, emphasizing that theme remains a central feature in escape rooms.

e) Narrative and Puzzle Organization

Narrative can be defined in several ways and there are differing opinions around the meaning of narrative in games (Backe, 2012). However, it is a common assumption that a narrative is a series of events perceived in a logical sequence (Backe, 2012).

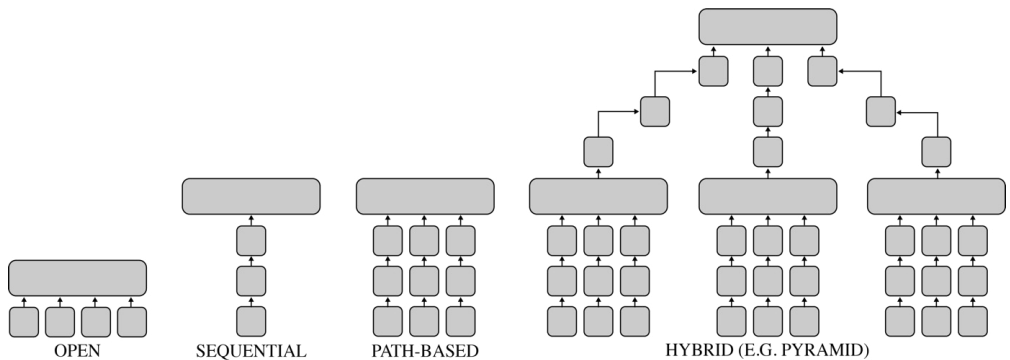
While both recreational and educational escape rooms can include a theme and a narrative, recreational versions tend to rely on aesthetics to support the theme rather than on a fully developed story (Nicholson, 2015). This could be why the model from Krekhov et al. (2021) does not consider the narrative, while both reviews of educational escape rooms list the narrative as a key design (Botturi & Babazadeh, 2020; Clarke et al., 2017). Indeed, games with an educational purpose tend to incorporate storytelling to increase immersion, engagement, and motivation (Naul & Liu, 2020).

Furthermore, both Botturi and Babazadeh (2020) and Clarke et al. (2017) include the game flow or structure as a design element. In the context of escape rooms, we can describe game flow or structure as how designers plan for the game to progress and, if there is a narrative, which elements of the story should be enjoyed and when. Rather than game flow, Krekhov et al. (2021) talk about *puzzle organisation*, which is how all the puzzles and tasks are connected and the order in which they are solved. The difference between game structure and puzzle organisation can be blurred with escape rooms, which are a list of puzzles linked by a theme and/or a narrative. Aarseth (2012) also suggests that players will perceive the structure of the narrative depending on how the game world is structured. Indeed, looking at both the ways a narrative and a game can be structured, we can find similarities.

The narrative can be structured as a linear or non-linear series of events. The narrative is linear (or embedded) when the story is crafted by the designers and told to players. In this case, events are predefined by the author or designer. This type of narrative is pre-generated and used to justify events and actions in the game as well as to motivate players (Salen & Zimmerman, 2004). This narrative is instead non-linear (or emergent) when it emerges as players engage with the game, so it is more complex and unexpected as it depends on players' choices. The events can change and are not under the strict control of the author/designer. Games can also combine linear and non-linear elements (Backe, 2012). For example, a larger narrative can be embedded but there can be emerging moments.

Similarly, a game world can be linear, open, or multicursal/mixed. In escape rooms specifically, this is largely reflected in how puzzles can be organised (Nicholson, 2015) (Picture 1):

- *Open*, where puzzles are solved at the same time and provide the solution to win the game.
- Sequential or *linear*, where puzzles are solved one after another in a specific order. Puzzles usually provide solutions for subsequent puzzles. Digital escape rooms often organise puzzles in this way (Makri et al., 2021).
- *Path-based*, where puzzles can be solved following a set number of paths.
- *Hybrid*, which combines different paths (e.g. to create a Pyramid).



Picture 1: Puzzle organisation

Source: own processing based on Nicholson (2015) and Veldkamp et al. (2020)

The fact that the narrative structure is provided by the puzzle organization - meaning the order in which the puzzles are presented and solved (Krekhov et al., 2021) – is not only a key design element but also one that differentiates escape rooms from most other games. In more common game narratives, events unfold to express a plot and reveal a story (Ip, 2011). For example, linear narrative structures often follow the three-act model borrowed from literature and film scriptwriting (Lindley, 2005). This structure divides the story into three main parts: beginning or setup, confrontation, and resolution. Another popular narrative framework is the hero's journey, which traces a protagonist's path through various stages (Lindley, 2005).

However, in escape rooms rich in storytelling, the narrative may extend beyond mere puzzles. It becomes a sequence of events or stories. When discussing educational escape rooms, Botturi and Babazadeh (2020) argue that content can be delivered through both a story and puzzle-solving. In games, storytelling can be supported in three main ways (Zubek, 2020), as illustrated in the table below (Table 2). An escape room can employ any of these methods to support a narrative and guide players through the game. Hence, we define *narrative* as a blend of *puzzle organisation* and *storytelling methods* (although only the former will be relevant for some escape rooms).

Table 2: Methods to support storytelling

Explicit or Exposition	Non-player character (NPC) Interactions	Environmental
Cut-scenes	Scripted conversation to provide additional information	Different areas of the game may provide different information
Through game objects such as storybooks and bestiaries	An NPC reacts to the players in pre-scripted ways	An area can suggest a story through visual cues (e.g. traces of blood) or sound

Source: own processing

f) Puzzles Design

Puzzles are a key element of both recreational and educational escape rooms, although puzzles are sometimes less complex in the latter (Veldkamp et al., 2020). Furthermore, the three models indicate that the puzzle design should follow other choices (Table 1), such as the target audience, the narrative, and/or the purpose (Nicholson, 2015). Thus, creating the puzzles is not an easy task as they need to: 1) support the chosen purpose; 2) adapt their challenge level to the selected audience; 3) integrate well with the theme and the narrative.

According to Browne (2015), there are so many different types of puzzles that it is also not possible – or even useful – to define them. For example, there are word puzzles, jigsaw puzzles, logic puzzles, dexterity puzzles, physical puzzles, and physics-based puzzles (Browne, 2015). Hence, there is no official taxonomy of puzzle types. Nevertheless, there have been some efforts to classify puzzles, depending on which elements are taken into consideration and how (Davanzo, 2021). For example, based on Wiemker et al. (2015), Makri et al. (2021) lists three broad types of puzzles:

- Cognitive puzzles rely on thinking skills and logic. For example, counting is very popular (Nicholson, 2015). Other types of cognitive puzzles could include cryptograms and riddles. In general, cognitive puzzles seem to predominate in digital versions (Makri et al., 2021).
- Physical puzzles rely on physical skills. For example, searching for hidden objects and using a light are very popular (Nicholson, 2015).
- Meta-puzzles depend instead on the narrative, where solving a puzzle provides an item or data that is essential for solving another puzzle and progressing the narrative.

But there have been also other classifications, some of which are less broad or take into consideration more elements (see Table 3). These classifications often include logic and mathematical puzzles, riddles and word puzzles, mazes or some other type of exploration. For example, Lindley's (1897) lists specific types of mathematical puzzles based on numbers or geometry (forms and shapes). Brathwaite and Schreiber's classification of puzzles also includes many puzzles based on cognitive skill (Brathwaite & Schreiber, 2008). This may be because their classification focuses on the digital version of escape rooms where cognitive puzzles are often preferred (Makri et al., 2021). For instance, their classification includes puzzles that require some 'out-of-the-box thinking' (lateral thinking) as well as puzzles solved by finding/using an item (item use) or reaching a specific point (exploration). While this classification is based on video games, escape rooms can take many forms including physical rooms, boardgames, digital games, and mixed experiences such as augmented reality. Hence, a comprehensive classification of puzzles should take into account both cognitive and physical skills. For example, Lindley's (1897) classification also includes mechanical puzzles with a tangible element such as containers with secret compartments, physical puzzles, or puzzles with multiple complex shapes.

While De Kegel and Haahr’s classification (De Kegel & Haahr, 2020) includes 11 categories including cognitive and physical puzzles. For example, there are puzzles solved by sliding shapes (sliding puzzles) or items (sokoban-type) in a specific order or configuration; by arranging items of different shapes to create bigger objects (assembly); or by using items or skills to link two points (path-building).

Depending on how broad a classification is, some puzzles can fit within one or more categories. Some puzzles may also require both cognitive and physical skills. For instance, traditional mazes (paper-based or digital) usually require cognitive skills, while hedge mazes require players to also physically move through the maze (Pai Raikar, 2022).

Table 3: Classifications of Puzzle Types

	Makri et al.'s classification	Lindley's classification	Brathwaite and Schreiber's classification	De Kegel and Haahr's classification
Mathematical/Numerical/Geometrical	x	x	x	
Mechanical/Dexterity/Physics/Secret container	x	x		
Assembly				x
Word/Language	x	x		x
Logical/Logic/Philosophy	x	x	x	x
Riddles/Dilemma	x	x		
Spatial reasoning			x	
Pattern recognition/Matching			x	
Path building				x
Exploration/Maze	x		x	x
Item use	x		x	
Sokoban/Sliding				x
Tile-match				x
Narrative	x			x

Source: own processing

While the four classifications presented here (in Table 3) are quite comprehensive, there are some limitations, mainly due to the wide range of puzzle types. Some types of puzzles are not formally cited as an example in the majority of classifications, yet could be included, either in one of the suggested categories or in new category. For example, spotting the difference and pattern recognition/matching could be grouped together in a category based on keen observation, while memory-based puzzles could be included in a cognitive-based category such as the one suggested by Makri et al. (2021) together with other puzzles based on logic and thinking skills like mathematical puzzles. And we could also argue that word puzzles and riddles also require cognitive skills.

Both Makri et al. (2021) and De Kegel and Haahr (2020) cite puzzles that are based on the narrative. This makes sense as narrative is a key element in the design of escape rooms with a purpose. Narrative-based puzzles are fully integrated into the narrative, and are part of its progression (De Kegel & Haahr, 2019). For example, these puzzles may require exploration to find context-based items or information (e.g. puzzles requiring social interaction with game characters or other participants) as well as logical and creative

thinking to proceed with the narrative (De Kegel & Haahr, 2019). To conclude, based on the review of the different classifications (Table 3), we propose the following puzzle classification for escape rooms with a purpose:

- *Intellect*: puzzles involving cognitive and creative skills, including mathematics, memory, and logic as well as word puzzles and riddles.
- *Dexterity*: puzzles based on dexterity, speed and physics (e.g. gravity in *Tetris*).
- *Exploration*: puzzles involving exploration to gather new knowledge and increase players understanding of a place or object. Exploration puzzles may include secret containers, mazes, and finding items.
- *Observation*: puzzles where players need to look at objects and/or environments carefully, for example, to spot a difference, match patterns or pattern recognition.
- *Creation*: puzzles that create shapes, images or paths, including path building, sliding and Sokoban.
- *Narrative*: puzzles that require to collect/find an item (e.g. drag and drop) or socially interact with other participants/characters in the game to continue the story.

Finally, while Krekhov et al. (2021) considers *hints* as a key design element, Botturi and Babazadeh (2020) and Clarke et al. (2017) – who both focus on educational escape rooms – do not include hints in their categorisations. Hints may be more important for recreational rooms than for educational ones, which may prioritize sharing educational content rather than providing clues to solve puzzles. Thus, we decided not to include hints in the initial framework.

g) Evaluation

Clarke et al. (2017) is the only model that includes *evaluation* as a key design element. While playtesting escape rooms is essential to identify issues (such as usability) and balance game challenges (Murphree et al., 2020; Nicholson, 2015), escape rooms with a purpose do not always undergo such evaluation. This is because they often have fewer resources available for evaluation compared to recreational ones (Ang et al., 2020). Consequently, Botturi and Babazadeh (2020) did not consider *evaluation* a key design element. Nevertheless, an escape room with a purpose may still require evaluation to determine whether the intended purpose was achieved and, if not, to understand why the game did not have the desired impact (Murphree et al., 2020). For example, developers may design surveys to evaluate learning outcomes or collect in-game data to track players' decisions (De Angeli & O'Neill, 2020).

Case Studies: Using the Framework to Analyse Existing Escape Rooms

In this section, we analyse three escape rooms with a purpose to investigate the framework's effectiveness. Our aim is to verify whether the initial framework is complete – so it already includes the key design elements of escape rooms with a purpose – or if a revision is needed.

We first identified the three games. The first game was developed by the author's company (*Unlock Bath*), while the other two were found by searching through the directory

of Games for Change, which houses an extensive collection of serious games – over 150 titles in total (“Game directory”, n.d.). The games were selected following four criteria:

- Escape rooms: we specifically considered games where players must achieve a goal by solving puzzles in a themed environment.
- Escape rooms with a purpose: Our focus was on games that align with the definition provided in this paper for ‘escape rooms with a purpose’. These purposes could include broadcasting a message, training, or exchanging data.
- Available gameplay: we ensured that the selected games were either playable (online or in proximity to the authors) or had their full gameplay recorded and shared (e.g. via YouTube videos or academic publications).
- Design process information: To gain deeper insights into their design, we sought games with available information about their development process. This could include reports, behind-the-scenes videos, or academic publications.

Then, we ran a qualitative content analysis of the three selected games (Table 4). There are different methods to analyse the content of games, based on different elements or aspects. For example, Consalvo and Dutton (2006) suggest making an inventory of game objects, to analyse the user interface and the different ways in which players can interact with objects. However, our primary objective was to understand how escape rooms with a purpose are designed. To achieve this, we either played the games or closely observed gameplay and we used the initial framework to take note of the following design elements into an Excel sheet:

- Purpose: we noted the purpose of each escape room (broadcast a message, train, exchange data);
- ‘Players’ goal or winning condition: we recorded what players needed to achieve within the escape room (escape from a locked environment, solve a mystery, or accomplish a task);
- Target audience: we noted the intended audience for each escape room, spanning various demographics (preschool, schoolchildren, teens, college/university students, professionals, general public) and number of players (single-player, multiple players);
- Equipment: we recorded the type of platform (physical, digital, mixed) and interaction modality (compute controls, gaming controllers, mobile interface, tangible) used in the escape room;
- Theme: we noted the thematic setting of each escape room (historical, futuristic, fantasy, horror, scientific, military, everyday life, steampunk, seasonal, pop culture, no theme/abstract);
- Narrative: we recorded how the narrative is woven into the puzzle organization (open, sequential/linear, path-based, hybrid) and the storytelling methods (explicit or exposition, npc interactions, environmental, no storytelling);
- Puzzle design: we noted the types of puzzles within each escape room (intellect, dexterity, exploration, observation, creation, narrative);
- Evaluation: we recorded if and how the game was evaluated (i.e. which method was used to evaluate the escape room).

Furthermore, we delved into the design process followed by escape room creators. By doing so, we gained a deeper understanding of their thought processes and how the games were developed. Our main goal was to test the framework in practice, ensuring its effectiveness in identifying the key features of escape rooms with a purpose.

Unlock Bath

Unlock Bath (“Unlock Bath”, n.d.) is a single-player digital escape room developed in 2022 for the web using Unity and a keyboard/mouse as an interaction modality. In it, players step into the shoes of a researcher from the future with the mission of travelling back in time to investigate a colour-changing phenomenon related to the city of Bath.

Through the game, players learn about the story of Bath from different perspectives. Bath has a very rich yet socially divisive history. Throughout the centuries the city was promoted and invested in by the wealthy yet developed and shaped by the workers. So the purpose of this game was to broadcast a message: there are different sides to every history. In particular, the game wishes to inform players about the stories of both the wealthy and the working class, exploring the brighter and the darker times that shaped Bath into the city that is today. The theme is historical, and the game is targeted at the general public. The puzzles are path-based with four parallel paths of puzzles, each with three puzzles. Players need to solve all the puzzles to collect the clues to solve their mission. They can start from any path, although these paths sometimes cross and players may have to solve a specific puzzle from a path to unlock a puzzle in another path. The game deploys two out of the three storytelling methods:

Explicit or Exposition: the player is given information related to the narrative through a specific game object: a file with papers and photos. This happens at the beginning of the mission when the player is given the mission file, and then every time a puzzle is solved, when players get extra information in their file.

Environmental: the game includes a main area that can be used to explore 4 sub-areas relevant to Bath (Quarry, Colliery, Health, and Prehistory). The main area includes a map of the city of Bath, to which details are added as the puzzles are solved, and four photos, each representing a sub-area. Each area has different visual clues (background and objects) that support the story. Each sub-area includes three puzzles, with a total of 12 puzzles classified as follows:

- Intellect: 1 puzzle (memory);
- Dexterity: 2 puzzles (push a button at a specific time);
- Exploration: 0 puzzles;
- Observation: 2 puzzles (spot the difference);
- Creation: 4 puzzles (sliding or swapping tiles);
- Narrative: 3 puzzles (drag and drop item).

The game was developed by Echo Games CIC, a community interest company specialising in the design of serious games, in collaboration with five museums. The development followed an integrative design process, which is collaborative and iterative. The integrative design process follows 3 stages:

1. Co-discover to set the purpose of the game together with the stakeholders, in this case, five partner museums.
2. Co-design where you implement the theme and narrative together with stakeholders. In this phase, the game company – Echo Games CIC – co-designed the narrative with museum professionals, deciding together which stories to tell and with which objects. The game was then developed by a team of five, a mix of developers, artists/creative directors and researchers/writers.
3. Co-evaluate to ensure that the theme and narrative match the game’s purpose. The content and the narrative were evaluated by the museum professionals. Museum professionals read an overview of the narrative and the game content and shared their written feedback via email. This was to ensure that the narrative was authentic but also represented each museum’s voice. The players’ experiences with the game have not been evaluated yet.

Tracking Ida

This is a multiple-player alternate reality game (mixed) created in 2017, where players interact with tangible items and with their mobile devices (“Tracking Ida”, n.d.). The theme is historical and the game is based on Ida B. Wells’ investigative journalism in the 1890s. Players study to learn about Ida B. Wells’s journalistic work in favour of civil rights and her investigative method. They then apply this method to investigate contemporary killings (Amde, 2017).

Through the game, players solve puzzles to unlock Wells’ truck and uncover her story. The main purpose of the game is both to broadcast a message and train. Firstly, the game wishes to make (difficult) history more accessible to the youth (broadcast). Most of Wells’s work was destroyed, so this project also aims to reclaim this lost history based on surviving archives and fill the gaps with historically plausible information. Secondly, the game wishes to train young people to be inquisitive like Wells.

The game also has a well-defined target audience as it was created for black youth (i.e. young). While there are some digital components, the game is mostly physical and hands-on, including historical artefacts and primary documents. Players are high-school students who collaborate to explore historical archives using a phonograph but also role-play as journalists who interview members of their community and raise awareness about specific issues affecting their community through social media.

The puzzles are presented in a sequential/linear order and divided into three phases. In the first phase, players are at their high school and need to solve a series of puzzles to unlock the compartments of a trunk full of Wells’ belongings. Players need to search the trunk for hidden compartments and a variety of items (mostly letters). Students also need to find an item, a phonograph, to be able to get clues from those letters. These puzzles can be mostly classified as exploration.

However, the game also includes role-playing, as in the second phase players are invited to apply the investigative skills they learned in the first phase to go into their community and interview people connected with youth who had recently been killed by the LAPD. This phase involved a school trip to a non-profit (community-based) social services organization. Since this also requires players to explore an environment to find new information, we also classify this second phase as exploration.

In the third and last phase, players return to the trunk at the high school. After they type the headlines for their interviews on a typewriter, a key falls out. The key opens a locked compartment where they find a vinyl record with a message from Wells. This last puzzle is strongly connected with the narrative and requires students to find data (interviews) and an item (a key) to complete the story. We can classify this last puzzle as narrative.

The narrative was supported by explicit or exposition storytelling, through the letters found by players. In some way, there was also NPC interaction as when players placed a letter in the phonograph, they would hear Wells’ voice, but also when they interviewed members of the communities.

The design process was iterative and involved a team of 6 designers and the story was written in collaboration with a historian. The main designer – a university researcher – had an initial concept and a purpose (“Tracking Ida”, n.d.). The narrative and the puzzles were then refined through the iterative process. There was also a post-evaluation using an ethnographic method to evaluate whether Tracking Ida was educational but also increased civic engagement.

One Leaves

One Leaves (Wahoo Studios, 2019) is a single-player digital game developed for Xbox and PC platforms using the Unreal Engine. Players can interact using either a keyboard/mouse or a game console. This is a horror-themed game where players are trapped in a hellish maze with 3 other NPCs. They need to solve a series of puzzles to be the first one to exit. If one of the other NPCs leaves first, the player loses. The purpose of the game is to broadcast a message and a very clear one: smoking is bad! The game tries to raise awareness of the fact that smoking harms your health and is difficult to stop. Indeed, the game is inspired by the fact that only 1 out of 4 teens who start smoking can stop.

The main target is teenagers (i.e. young). The game is set in a building with different floors. Each floor is a different environment: a school with a library, a hospital with a morgue, and a sewer. Players can move between floors using an elevator.

The puzzles are presented in sequential/linear order. The main puzzle is a maze, represented by red cables on the floor that players need to follow (exploration puzzle). Players also need to explore where 4 morgue doors lead to find the exit (exploration puzzle). In the library, players need to move bookshelves around to find a path out, much like a Rubik's cube (creation puzzle). The game then includes a flashlight puzzle, which is located in the Hospital. Players need to turn on a series of lights in a specific sequence to gain access to a flashlight. This flashlight will then help them navigate the rest of the game and find items like an iron lung machine. This puzzle is a mix of intellect and observation.

Storytelling is delivered through NPC interactions and environmental visual clues. An unseen narrator describes the scenario to players and provides additional information, while visual clues such as blood support the narrative that smoking is unhealthy as well as the horror theme.

The game was developed by the game company Wahoo Studios in collaboration with the FDA's Centre for Tobacco Products. No information was shared about the design process itself or its evaluation. No papers or reports were published to share findings about the impact of the game.

Discussion and Conclusion

In this paper, we explored the design of escape rooms with a purpose, which we defined as: *games developed with a purpose beyond entertainment where players solve puzzles within a themed environment to achieve a goal*. After providing an overview of the history and evolution of escape rooms, we delved into their potential purposes. We identified three broad categories: broadcast a message, train, and exchange data. Subsequently, we conducted a literature review spanning the fields of serious games, escape rooms, and puzzle design to explore how escape rooms are designed. This review allowed us to pinpoint a series of relevant design elements, which collectively formed a framework for designing escape rooms with a purpose.

To test this framework in practice, we analysed three case studies: *Unlock Bath*, *Tracking Ida*, and *One Leaves*. Our analysis involved comparing the design elements of each escape room and examining their design processes (Table 4). Based on this analysis, we finalized a list of design elements. Some elements were confirmed, such as purpose, goal/winning condition, theme, and narrative. Additionally, we refined or even added other design elements. The resulting list now constitutes our proposed framework for designing escape rooms with a purpose. This same framework can be also employed to conduct content analyses of such games, as demonstrated in our examination of *Unlock Bath*, *Tracking Ida*, and *One Leaves*.

Table 4: Summary content analysis of three escape rooms with a purpose

	Unlock Bath	Tracking Ida	One Leaves
Purpose	Broadcast a message (history is about telling different sides of a story)	Broadcast a message (important to reclaim difficult history); Train (investigative journalists)	Broadcast a message (smoking is bad)
Goal	Solve a mystery (why is the brick blue?)	Accomplish a task (unlock all the compartments of Well's trunk)	Escape from a locked environment (exit the building)
Target	General public; Single-player	Teens (black youth); Multi-player	Teens; Single-player
Equipment	Digital Computer	Mixed Tangible and mobile	Digital Computer or controllers
Theme	Historical	Historical	Horror
Puzzle organisation	Path-based	Sequential/linear	Sequential/linear
Storytelling	Explicit/Exposition, Environmental	Explicit or Exposition, NPC interaction	NPC Interactions, Environmental
Puzzles	Intellect, Dexterity, Observation, Creation and Narrative	Exploration and Narrative	Exploration, Creation, Intellect/Observation
Evaluation	Qualitative evaluation of the narrative with stakeholders	Ethnographic study to evaluate the impact on learning and civic engagement	NA
Process	Iterative and collaborative (museum professionals)	Iterative and collaborative (historian)	NA

Source: own processing

a) New Design Elements: 'Concept/idea' and 'Stakeholders'

All the three escape rooms started with a clear concept or idea, but not necessarily with a clear purpose. This suggests that defining a purpose is not necessarily the first step in designing an escape room with a purpose. For example, the purpose of *Unlock Bath* was finalised through a collaborative process, involving *stakeholders* in the full design of the escape room. A stakeholder is a person that would be directly impacted by the escape room. Hence, stakeholders may include not only the target players but also the game developers and the museums sharing their stories. In *Tracking Ida*, an expert in history was engaged during the design process, also emphasizing the importance of involving relevant stakeholders.

b) Additional Notes on 'Narrative'

Once the purpose is set, a key design challenge will be to align the *puzzle design and organisation* with this purpose. We previously argued that puzzles can be organized in four ways: open, sequential/linear, path-based, and hybrid.

Unlock Bath organised the puzzles in multiple paths. A structure where multiple puzzles can be solved in parallel is beneficial for players (Schell, 2014). If players cannot solve a specific puzzle and get stuck, they may get tired and lose interest in the game. A parallel organisation (e.g. path-based or hybrid) would allow players to choose between different puzzles, increasing engagement and extending interest (Schell, 2014). However, such puzzle organisation can also be difficult to plan, especially when you have a clear idea of what the players should experience and when. If developers have a very clear goal and purpose in mind, they may want players to follow a pre-set narrative. This may be the

reason why a Sequential/linear structure was preferred by *Tracking Ida* and *One Leaves*. If an escape room has limited or no storytelling, the focus primarily rests on puzzle organization. Designers need to carefully plan the puzzle flow. However, when storytelling is a significant component, designers can enhance the narrative using suggested methods: explicit or exposition, NPC interactions, environmental (Table 2). *Unlock Bath*, *Tracking Ida*, and *One Leaves* each employed two of these three methods.

In summary, the interplay between narrative and puzzle organization significantly impacts the escape room experience. Designers must strike a balance to create escape rooms that are engaging while achieving their purpose.

c) Revised Elements: 'Puzzle Design' and 'Equipment'

Once the organisation of the puzzles and the storytelling methods are finalised, it is time to design the puzzles. This can be a challenging task as there are many types of puzzles. We identified six main categories of puzzles: intellect, dexterity, exploration, observation, creation, and narrative. Selecting the right puzzles depends on the *narrative*, *purpose*, and *goal* of the game:

- *Tracking Ida*: This escape room includes exploration and narrative puzzles. Given that the narrative revolves around an investigative journalist training young people to be inquisitive, exploration puzzles align perfectly. Solving a mystery requires exploration to uncover clues.
- *One Leaves*: It primarily features exploration puzzles. The game's goal is for players to exit a building, and exploration puzzles enhance players' understanding of the environment. The simple purpose of broadcasting an anti-smoking message does not require an elaborate narrative, which may be why there are no narrative-based puzzles.
- *Unlock Bath*: Developed in collaboration with museum professionals, it emphasizes storytelling and historical artifacts. The purpose – to convey that history involves multiple perspectives – led to a majority of creation and narrative puzzles. These puzzles allow players to engage with key artifacts and characters, reconstructing specific elements of history.

Once developers decide which puzzles to design, another challenge would be how to balance these puzzles based on the targeted players. One solution to balance the game, especially with a diverse target audience, could be to set *play modes*. Nicholson (2015) suggests three modes or *difficulty levels*:

- casual, which may provide more hints or even solutions;
- standard, which may provide clues but not solutions;
- hardcore, which provides only a limited amount of support. This mode may also include harder puzzles and red herrings.

By adjusting the play mode, designers can tailor the escape room experience to different audiences. Here's how these modes can impact the game:

- *Timing*: The mode could set different time limits for completing the escape room.
- *Puzzle Variety*: Each mode might present different puzzles or alter existing ones.
- *Clues and Hints*: The level of assistance provided (hints, clues, or solutions) can vary based on the chosen mode.

Hints, in particular, appear to be more important than we initially thought, as they can help players both progress and maintain interest (Schell, 2014). Based on our analysis, we agree with Krekhov et al. (2021) that a *hint system* should be included in the design

of escape room, especially when puzzles lack easy instructions or introductions to mechanics. For example, in physical escape rooms, there is usually someone to monitor players and provide hints when needed, while in digital games, hints could be provided via NPC interaction or a help button.

The choice of *equipment* (platform and interaction modality) will also depend on previous choices, especially on the purpose of the game and its target audience. For example, *Unlock Bath* was developed as a digital game to reach a wider audience. Instead, mixed versions could help physically and virtually engage with the members of a local community. This was the case with *Tracking Ida*, where players could post their findings on social media. Mixing digital and analogue elements may also help improve the social experience, which is often a limitation of fully digital games (Nicholson, 2015). But while physical/mixed games can be more collaborative, they can also trigger issues of privacy and safety, especially if strangers may be watching as we play (De Angeli, 2022). The game experience always happens in a *place or location* (Schell, 2014), whether it is on our sofa at home or in a public space like a museum or an arcade hall. Each location comes with its opportunities and challenges. For instance, digital escape rooms may be less collaborative but can be played at home, and this can provide the safety and privacy needed to fully immerse ourselves (De Angeli, 2022). Thus, developers should carefully think about the place in which their games will be played, whether it is private or public, and this decision should be influenced by both the purpose and the stakeholders. In turn, the location may influence the platform and interaction modality. For example, *Tracking Ida* was designed to engage with shared history and interact with the local community. Hence, public locations are chosen for this game (i.e. a high school and a community organization). This translated into an experience that is mostly physical, with some digital elements (i.e. engaging with the community through social media).

d) Final Framework

A framework for the design (and analysis) of escape rooms with a purpose was developed based on literature review and case study analysis. While individual elements may not be entirely new – since they were extracted from various studies related to escape rooms, serious games, and puzzle design – their combination into the proposed framework represents a novel contribution. Designers can use this framework to explain the creation of *Escape Rooms with a Purpose* or guide the content analysis of existing ones (Appendix A).

e) Limitations and Future Studies

The three analysed escape rooms were either fully digital or with a digital component (Table 4). Digital versions are easier to find and play online, which may explain why we could not identify any physical escape rooms with a purpose. Nevertheless, in the future, we wish to use our framework to analyse more escape rooms with a purpose, including physical ones.

While the framework can already be used for content analysis of existing escape rooms, it could be also expanded to include other qualitative methods, such as analysing players' comments in online forums. For example, while there was no official evaluation of *One Leaves*, there were some interesting comments in gamers' forums such as Metacritic, TrueAchievements, and Garage Band Gamers. From those comments, it is clear that players enjoyed the theme, the music, and the general design of the game. However, players often commented how they did not realise there was an anti-smoking message, and when they did, they felt it was more as an advertisement against smoking than a game. This suggests that better communication of the game's purpose would have been beneficial.

Further studies could explore how developers of escape rooms with a purpose could effectively convey their game's purpose to manage expectations, maintain trust, engage players, and ultimately achieve their intended goals.

Finally, through this paper we identified two interesting gaps concerning the design of escape rooms with a purpose. Firstly, while there have been some successful examples of game designed with the purpose of exchanging data (Schrier, 2016), we could not find any examples of escape rooms specifically designed to process and analyse data. For example, through the computer game *Foldit* (University of Washington, 2008) players can contribute to research in the field of protein folding while the mobile game *Sea Hero Quest* (Glitchers, 2016) provides data for Alzheimer's research. The goal of the first game is to find the best solutions to fold the structures of given proteins. These solutions are then investigated by scientists, for example to cure diseases. In the second game, players control a boat in the sea, thus helping scientists to better understand human navigational abilities. Similarly, escape rooms could be designed and evaluated to collect data about a variety of human skills, including problem-solving, communication, memory and other cognitive skills. This could feed into research into, for instance, health (e.g. dementia), creativity and teamwork. While escape rooms have been already used to explore teamwork (Cohen et al., 2020), research and development in the field is still rare and limited, for example, to players sharing data but not processing it.

Secondly, none of the three analysed escape rooms included an official debriefing. However, debriefing is key to supporting game objectives such as learning (Buchner et al., 2022) or even critical reflection (De Angeli et al., 2021). For example, Nicholson (2015) highlights that debriefing is – or should be – a key element of escape rooms. Debriefing techniques are used, for example, to help participants return to the 'real world, both mentally and emotionally' (Nicholson, 2015). Debriefing may also help avoid overwhelming players. Thus, future work could explore the use of different debriefing methods in escape rooms with a purpose as well as their impact on players.

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APPENDIX A: CHECKLIST

Concept/idea:

Stakeholders

Who are the Players?

- Preschool -----
- Schoolchildren -----
- Teens -----
- College/University students -----
- Professionals -----
- General public -----

Other stakeholders?

- Experts/consultants
- Museum professionals
- Teachers
- Healthcare professionals
- Policymakers
- Other: -----

Purpose

- Broadcast a message. Message: -----
- Train. Field/Topic: -----
- Exchange data. Data: -----

Goal/Winning Condition

- Escape from a locked environment. Environment: -----
- Solve a mystery. Mystery: -----
- Accomplish a task. Task: -----

Equipment

Location:

- Public: -----
- Private: -----

Platform:

- Physical
- Digital
- Mixed. Physical: ----- Digital: -----

Interaction modality:

- Keyboard/mouse
- Gaming controllers: -----
- Mobile interface: -----
- Tangible: -----

Theme

- o No Theme/Abstract
- o Historical
- o Futuristic
- o Fantasy
- o Horror
- o Scientific
- o Military
- o Everyday life
- o Steampunk
- o Seasonal
- o Pop culture,
- o Other: _____

Narrative

Puzzle organisation:

- o Open
- o Sequential/linear
- o Path-based
- o Hybrid

Storytelling methods:

- o No Storytelling
- o Explicit or Exposition
- o NPC Interactions
- o Environmental

Puzzle Design

Puzzle types:

- o Intellect _____
- o Dexterity _____
- o Exploration _____
- o Observation _____
- o Creation _____
- o Narrative _____

Difficulty mode:

- o None
- o Timing: _____
- o Different puzzles: _____
- o Hint system. E.g. social interaction, help button, other: _____

Evaluation

- o Interviews
- o Ethnography
- o Focus groups/participatory workshops
- o Analysis of players' comments from: _____
- o In-game data: _____
- o Survey. Which survey: _____
- o Other: _____

