Darkroom Mansion Postmortem

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Abstract

Darkroom Mansion is a mobile video game about the subject of chemical-based photographic processing. The game was produced for the Finnish Museum of Photography as part of an initiative to revive the interest in the darkroom and its associated practices. This thesis analyzes the design process of the game from my perspective as *designer* and *programmer*. The analysis offers a comprehensive look into the game in terms of structure and its corresponding aesthetics. These views serve as a basis to understand several aspects that are intrinsic to game design and development, and how they were perceived and approached for Darkroom Mansion. The thesis concludes with lessons learned from the overall development process of the game, and offers suggestions to approach the design of similar games more advantageously.

Keywords games, game design, photography, darkroom, puzzle, postmortem

Contents

1 Introduction

This thesis analyzes the design process of *Darkroom Mansion*. Darkroom Mansion is a mobile video game about the subject of chemical-based photographic processing. The game was produced for the Finnish Museum of Photography as part of an initiative to revive the interest in the *darkroom* and its associated practices.

In the game, players develop a selection of pictures, produced by renowned Finnish photographers in the darkroom, by means of solving interactive puzzles. In each of these puzzles, players interact with a variety of tokens on a *game board* represented by the photographic paper. The paper is initially *exposed*, and the picture later *developed* by matching some of these tokens with their corresponding *targets* on the board (Figure 1.1).

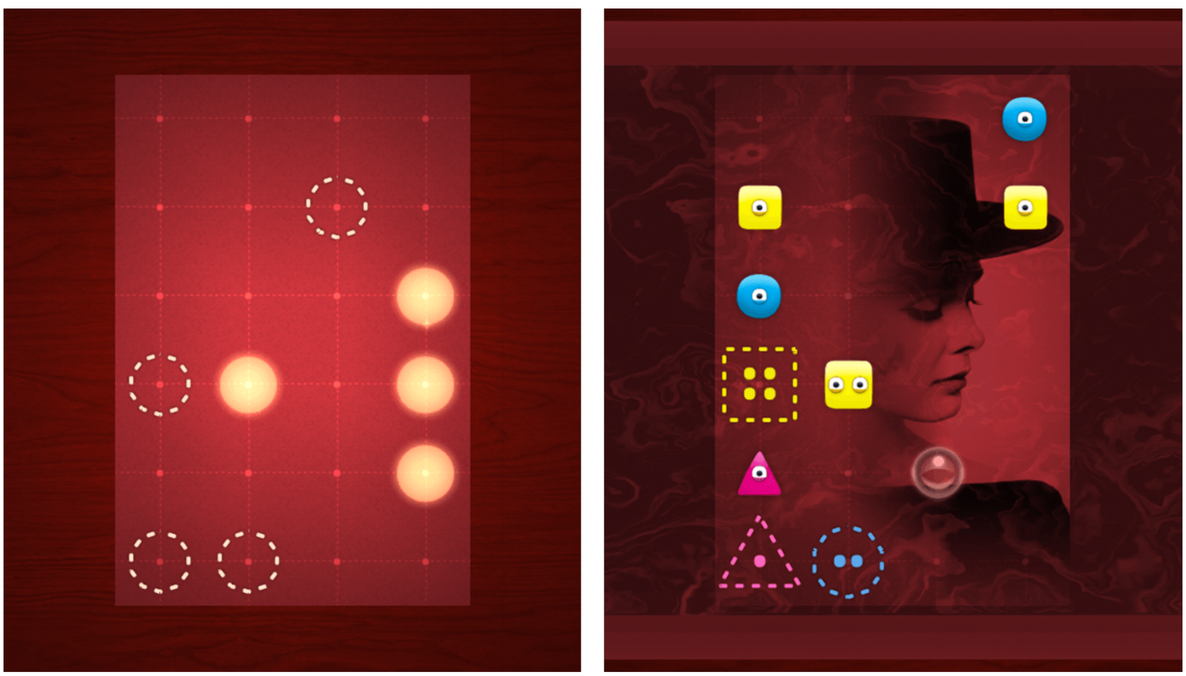

Figure 1.1: On the left, players expose the paper by matching the *light orbs* with the *targets* marked on the paper. On right, players develop the picture by combining *chemical agents* and matching them with their corresponding *targets*.

The developed pictures are later exhibited in the *mansion* where players can learn more information[1] about them and access new puzzles from the *empty frames* (Figure 1.2). Early in the game, the players learn that the mansion's photographic collection vanished mysteriously and that they are the only ones who could to recover the disappeared pictures. Along the way, players unlock new areas, collect the missing pieces of darkroom equipment and fight the evil that looms over the mansion.

Figure 1.2: On the left, a restored picture is surrounded by several other missing pieces of the mansion's collection. On the right, a collectible piece of darkroom equipment glitters.

Darkroom Mansion was released in mid-2017 for the iOS and Android platforms, and as of today it is available for free download. The release was followed by a launch event at the Finnish Museum of Photography, where children from the Sophie Mannerheim School in Helsinki were invited to play the game. This event marked the beginning of a public display of the game in the exhibition space at the museum, which lasted several weeks after its release.

1.1 Project background

In the late first quarter of 2015, the Finnish Museum of Photography started looking for a team who could develop their idea for a game. The game would be based on the

[1]Such as the techniques employed in their actual processing and anecdotes about subjects portrayed in the pictures as well as about the authors.

subject of chemical-based photographic processing as performed in the darkroom and would be aimed at children, ages 8 to 14. It constituted an attempt from the museum to engender in children a spontaneous interest toward this disappearing part in the photography culture (Rastenberger, 2014). For this purpose, the game was originally planned as part of an exhibition around the same topic, although aimed at a more mature audience, which took place between August 21 of 2015 and January 31 of 2016 (The Finnish Museum of Photography, 2015).

The preliminary concept for the game proposed an interactive experience through which the players would learn about the steps involved in the production of an analog photograph. The concept, however, only outlined the intended experience but did not go into detail about its structure or aesthetics. To that end, the museum required a team with relevant skills in the field of game design and production.

In their quest to find a fitting team, the museum reached out to the Department of Media, at the Aalto University School of Arts, Design and Architecture. Through Miikka Junnila, the main lecturer at the major of Game Design and Production, the museum aimed to find candidates for the design and development of their game idea. It was then, while attending my studies toward the same major, that I was suggested to apply for the job.

After taking part in a few meetings with the team leading the initiative on behalf of the museum, I became involved in the design and production of the game until its release in July 2017.

1.2 The team behind the game

At its core, the production team was composed of 4 people. First, Niklas Kullström, who in the past had worked in collaboration with the museum, acted as *producer* for the game. Niklas facilitated the communication with the museum especially with regard to content provision, logistics and financial matters. Niklas and I started working jointly as soon as I boarded the project as the *game designer* and *programmer*, in late April 2015. Our priority back then was to find a *game artist*, role that Salla Vasenius soon assumed. A few months later, when the production had already matured into a *first playable*[2], Can Uzer joined the project as the *sound designer* and *music composer*. Both Salla and Can were also students from the Department of Media at Aalto University at the time we started collaborating in the game. This situation made the communication and cooperation toward the game easier.

Along the way, however, several other people contributed actively in the project. On the one hand, the members of the museum staff who led the initiative, curating and composing narratives for the photographic material that would be later used in the game. On the other hand, Stefan Engblom, who then worked as a game designer at Supercell, advised the design process on several occasions until the game took form. In

[2]The game version containing representative gameplay and assets (Chandler 2009, p. 244), therefore functional and playable.

addition to them, many other people supported a diversity of production aspects. From 3D modeling to playtesting, their contributions helped greatly in shaping and refining the product toward its final state.

1.3 Thesis structure

This thesis is composed of 3 fundamental parts. The first part (chapter 2) is an analysis of the final game, that is, Darkroom Mansion as it remained published by the time this document was completed. The purpose of the analysis is for readers to understand the structure and aesthetics of the game. Particularly, I will try to elucidate the components that make the game engaging for children and adults alike. This understanding will shed light on the motivations behind the design decisions made during the design process. The next part of the thesis (chapter 3) covers the design process along its most discernible stages, such as the *brainstorming*, the *concept design* and the *prototyping*. Along the way, I will explain the major obstacles faced during their execution and how they were addressed. With hindsight, I will also identify some alternative approaches that should have been taken to hasten a process that was evidently protracted. These practical insights will serve as the basis to understand the postmortem (chapter 4), which comprises the final part of this document. In the postmortem, I will pinpoint and analyze particular aspects that went right or wrong during the design and production of the game. I will then conclude with the main lessons learned from the entire process, and suggestions on how to approach the design of future games more advantageously.

2 Game analysis

In this chapter I will analyze the game using the MDA game analysis framework. MDA stands for Mechanics, Dynamics and Aesthetics which represent each of the distinctive components of a game (Hunicke et al., 2004). The purpose of this analysis is to examine in detail the structure and functional aspects of Darkroom Mansion as well as their interrelations that serve as the basis of the gameplay experience. Thereby, I will elucidate the elements that differentiate Darkroom Mansion from any other game.

2.1 Mechanics

Hunicke et al. (2004) defines *game mechanics* as “the various actions, behaviors and control mechanisms afforded to the player within a game context”. What is most important about mechanics, and perhaps not obvious from this definition, is that they enable players to interact with the game (Järvinen, 2008, p. 73). In turn, these interactions affect the game state (Juul, 2005, Chapter 1) and are usually designed for players to overcome challenges imposed by these changes in the game (Sicart, 2008).

Some game mechanics can be best understood as verbs, as if the actions with which players respond to the requirements and changes in the game system (Järvinen, 2008, p. 74). In Darkroom Mansion, players *move* through the mansion, *select* frames on the walls, *swipe* tokens in a puzzle board and *collect* items as they *move* through the mansion. All of these actions affect the game state in different ways. Particularly, *moving* through the mansion causes the camera to reveal previously concealed parts of the environment, thus making possible the *exploration* of a much larger space than what it is displayed by the current game state. This exploration enables, in turn, other mechanics. For instance, *selecting* a frame from the walls along the players’ path causes the game state to transition into the *photographic processing* setting. There, players are presented with the challenge to *swipe* around a variety of tokens on a board in order to “process” a photograph. The crux of the challenge is, however, that the tokens are subjected to series of rules that delimit their behavior. By extension, players must conform to these rules for they are written in the mechanics that they are operating.

In Darkroom Mansion, all of the aforementioned mechanics have counterparts as *gestures* on a touchscreen. *Moving* across the mansion is deliberately achieved by *sliding* a finger on the screen, in the opposite direction of the desired movement as if scrolling through the contents of a webpage. *Swiping* the tokens in a puzzle obeys to the touch gesture with the same name. And *selecting* and *collecting* is achieved by *tapping* the object of interest on the touchscreen. This association is particularly advantageous is 2 forms. First, in which that it makes easier to describe and understand, from a developer perspective, the specific actions with which the player affects the game through the system interface. Second, in that it makes the mechanics almost intuitive for players, whom by the time they get a hold of the game are already familiarized with the basic mechanisms of control for touch interfaces.

Those covered so far represent, however, a high-level subset of game mechanics. These are the "control mechanisms" stated by Hunicke et al. (2004). Beyond these control mechanisms there are a variety of actions and behaviors supporting them (Ibid, 2004). For example, in the context of photographic processing in Darkroom Mansion, the tokens comprise a variety of components with different behaviors. There are *light orbs*, *bubbles* and *agents* that, when swiped, normally move toward the desired direction, vertically or horizontally, across the board and until facing and obstacle. Upon collision with others (or with the boundaries of the board), they will remain in the last free section of the board along their trajectory. This is the behavior for all of the puzzle tokens, except for the agents when they collide with another of the same kind (color and shape). Two like agents will combine into a composite one that is worth as many (up to 6) individual agents as there have been combined to that point.

Besides the mechanics that enable control and define the behavior of tokens in the board, there are as well mechanics for *matching* those tokens against certain *targets* on the board. These targets react when entering in contact with their agent counterparts. In the first stage of the puzzle, the *exposure*, both the targets and the light orbs are removed from the board when entering in contact with one another, and as a result the game flashes portions of an underlying image contained in the board. Likewise, in the ensuing stage of the puzzle, the *development*, targets and agents of the same worth and kind (color, shape and value) are removed from the board when entering in contact with one another, causing parts of the same overlaid image to become permanently visible on the board (Figure 1.1).

All of these actions, behaviors and control mechanisms are mechanics of Darkroom Mansion. They constitute the structure of a game; its parts and their interrelations, and define the way how the players interact with every aspect of the game.

2.2 Dynamics

In the previous section, I described how moving around enables the *exploration* of the mansion, which later brings players into a *photographic processing* setting in which they develop pictures by means of another subset of mechanics. Both, *exploration* and *photographic processing*, are emergent behaviors of the game. These behaviors arise when the mechanics are put into use and are not necessarily intrinsic to the mechanics. Particularly, matching agents and targets in the puzzle causes an overlaid image to gradually appear on the board as if a picture would be developed. However, that of "developing a photograph" is an emergent behavior. With some alterations the puzzle may have as well served another purpose. Particularly, if we replace the underlying image with a map and the agents with (part of) some sort of shells, an alternative behavior of remote bombardment within the context of a war game may as well emerge. Hunicke et al. (2004) define these emergent behaviors as *dynamics*. The dynamics make the mechanics meaningful and imprint purpose to a game.

Those dynamics introduced above are once again high-level dynamics; they are overarching and the result of the combination of numerous mechanics in the game. However, when processing the pictures there are many other dynamics resulting from the use, in combination, of a smaller subset of mechanics. For instance, tokens on the board such as bubbles and light orbs collide with each other or with the boundaries of the board through the mechanics already described in the previous section. Two emergent behaviors resulting from the interactions of these mechanics are (1) the *stacking* of tokens on the board, and (2) the *leveraging*. Both of these dynamics are complementary and refer to the behavior of stacking multiple tokens on the board, one after the other, in order to situate another into such position that it can be brought to its corresponding target. If there were a category to group these dynamics in the game, that would be of puzzle *strategizing*.

Dynamics can often be predicted but sometimes they can only be witnessed during gameplay. For instance, there were a few "counterproductive" behaviors that will be described in the subsection 3.4.2 which could only be observed when playtesting the game. Identifying these dynamics allowed me to make correctives in the underlying mechanics in order to prevent undesired responses from the player. In principle, designers "must consider interdependencies carefully before implementing changes" in the structure of a game (Hunicke et al., 2004).

2.3 Aesthetics

The "dynamics work to create aesthetic experiences" (Hunicke et al., 2004). That is, that the dynamics, and by extension the mechanics of a game, work in combination to produce emotional responses in the player. Ultimately, the aesthetics of a game is what makes them engaging in the first place. The MDA framework borrows Marc Leblanc's (co-author of the framework) taxonomy of game pleasures to illustrate a set of possible aesthetic goals which designers could be interested in pursuing when designing a game (Ibid, 2004). For instance, *challenge* as such is a common aesthetic goal that results from the "struggle", intrinsic of a game, that players experience when pursuing a goal (Costikyan, 2004).

Struggle is a dynamic of the game supported by other dynamics and mechanics alike. In Darkroom Mansion, the dynamic of time pressure, or the often insufficient tokens with which players need to resourcefully match possible targets in order the trigger the mechanic that spawns new agents on the board, are both dynamics that support struggle in the game. In turn, this struggle creates an aesthetic experience by which players become "emotionally invested" in the game (Hunicke et al., 2004). This emotional investment can be labeled as *challenge* by means of the taxonomy of pleasures stated above.

Sensation is another typical aesthetic experience in games, normally derived from visual mechanics and dynamics, although they may as well appeal other senses. In Darkroom Mansion, the graphics are appealing as such, at least to the extent of not driving players away from the game. Most importantly though, the visual mechanics that produce the underlying image in the puzzle board are what ultimately creates the sensation of being "developing a photograph" through the puzzle. This sensation is aided by a hint of *discovery* in the sense the player does not know what is in the picture until it becomes visible. Thereby can be evidenced how the design of game mechanics is usually driven by the emotional experiences they are meant to give rise to.

Figure 2.1: In the mansion, the pictures are shown in the state resulting from their best processing attempt.

Schell (2008, pp. 347-352) elucidates another subset of aesthetics that enhance the overall experience of a game. *Reward* is, for instance, paramount and albeit it may be implicit in other aesthetic experiences such as the reward of conquering challenge or by means of sensory pleasure, it is often intensified in game as a mechanism to increase the emotional investment of players. In Darkroom Mansion, the developed picture is an implicit reward that is supported by several mechanics. Namely, the subsequent exhibition of the produced pictures on the walls of the mansion and the possibility to inspect more details about them after they have been developed once. In addition to this, the game encourages to fully develop the pictures lest they will be shown partially developed in their corresponding frames and consequently rated below the 3 star mark (Figure 2.1). This enables a common dynamic in games, in which players will replay levels until they can obtain a perfect score and hence exploit the maximum reward that a game is designed to offer.

3 The design process

This chapter describes the most important stages in the design process of Darkroom Mansion. For each stage, I will highlight the most significant achievements attained toward the final design of the game.

3.1 Brainstorming

Right after I joined the project, there were several meetings held to discuss ideas about what kind of game we wanted to make. Some of these meetings were held jointly with representatives from the museum who provided guidelines about what was expected from the process. Among these guidelines, there were that the subject of chemical-based photographic processing, as performed in the darkroom, would be central to the game, and that it would be aimed at children between the ages 8 and 14 as the target audience.

The first ideas derived from the discussion were either too broad to be developed within the planned schedule, or too generic. Our initial schedule was composed of about 1 month for planning and 3 months for production. The initial schedule contemplated that the game would be ready by mid-August 2015 to be introduced as part of an exhibition being prepared by the museum about the darkroom (The Finnish Museum of Photography, 2015). However, despite the tight schedule, I persuaded the team to embark on a rather ambitious enterprise that would deliver a game experience worth playing for children.

The premise of maximizing the outcome of our scarce schedule and budget, put aside conventional ideas such as interactive jigsaw puzzles made of photographs, or platform games about collecting photography tools or supplies. Instead, we started to think about ways for the player to interact with the contents of the pictures, and to construct a plot connecting the subjects in those pictures which would pose mysteries for the player to unravel.

As these ideas evolved, however, we started to stray from the theme. Suddenly, the attention was focused on ingenious or unconventional ways for players to relate to the pictures than to the process of producing those pictures. In hindsight, a better approach would have been to first focus strictly in designing the game mechanics to convey the photographic processing, before building an arrangement of ancillary mechanics and narrative to increase their appeal.

Nevertheless, after several weeks of brainstorming, we started to narrow down the alternatives toward a first game concept. This concept combined the realism of the photographs with a unique, distinctive cartoonish style. Thereby, we could overlay the pictures with unrealistic elements that would remain feasible in the fictional context of the game. Therefore, even though the game was to be built in Unity® due to my previous experience with the engine, it was decided for the game to be in 2D. This decision was based on the assessment of the team's skillset, and once again the time and budget constraints.

Eventually, I put together a *first concept* for the game to be presented to the museum. The concept proposed game stages as walls, looked at frontally, decorated with frames (Figure 3.1). Interestingly, all these frames would be empty and the players would need to "turn off" the lights to see more. Switching the lights off would enable a *dark mode* in which the contents of the room would be tinged red due to the light source being turned into a *safelight*.

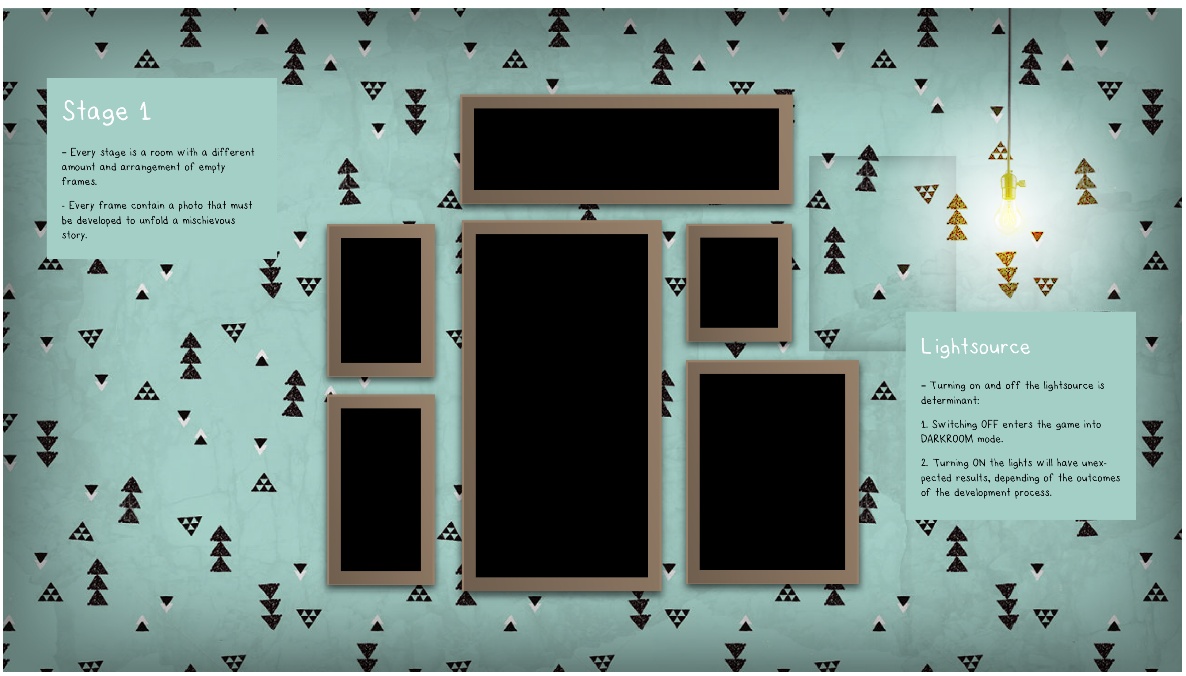

Figure 3.1: Game stages represented as frame arrangements on a wall. A light bulb serves as a toggle to switch the state of the room between the *light* and *dark* modes.

The idea about switching modes was to turn every room into sort of a darkroom. Then, players would be able to produce the pictures on-site. My motivation for these ideas was to minimize the amount of game areas to develop, as well as transitions to connect them. However, this concept already imposed a big limitation that we would carry over to several design iterations. The pictures would be developed within their corresponding frames and therefore this process would be achieved in a rather contrived way.

The Figure 3.2 shows quirky, blob-like, tiny helpers guiding the development of what it would be called a *memory*. In the context of the concept, a memory is essentially a picture, except that it does not require a physical medium to be perceived. Simply put, a memory would be a paper-less picture, and as such it could be developed out of thin air. Hence, the memory would be "exposed" after repeating on the touchscreen sequences of targets lit on a reference grid marked within the frame. This grid represented the play area that would be otherwise defined by the paper. Subsequently, the memory would be *developed* by matching a subtype of the same blob-like, tiny helpers dwelling in the depths of the frames.

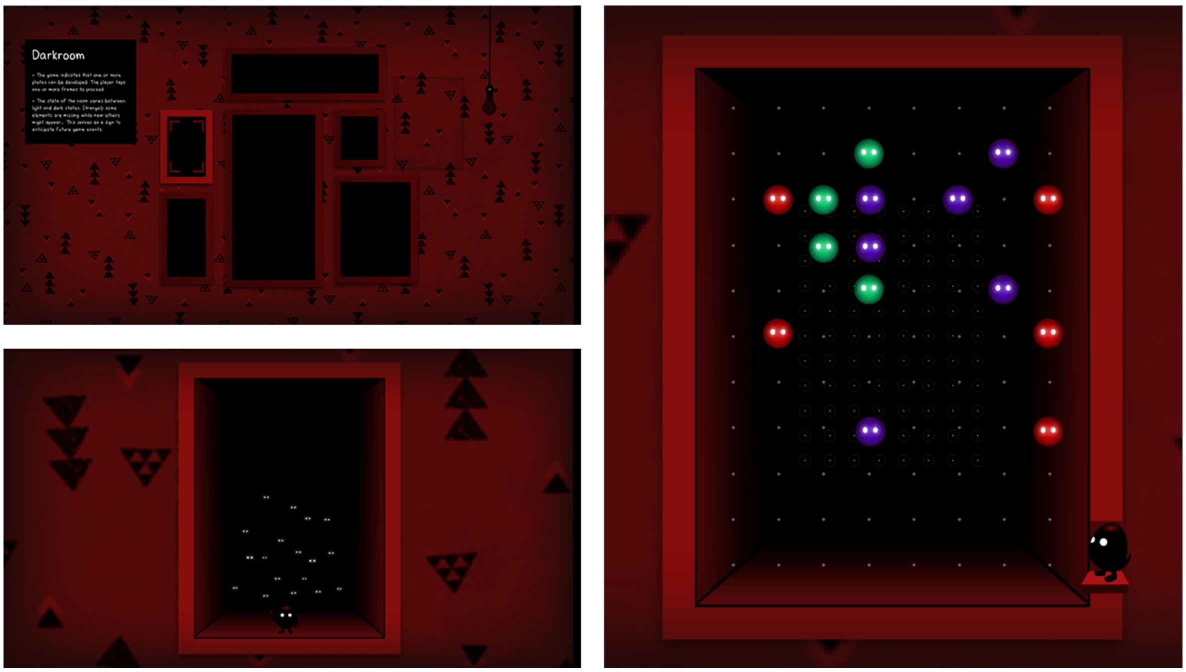

Figure 3.2: On the left, players are now able to interact with the frames while in the *dark mode*. On the right, players are taught to develop a *memory*.

Moreover, the concept proposed to construct a plot around the pictures in the room. In the Figure 3.3, the blob-like friend now manifested itself as a little white flame, moving within the frames. The little ally would start telling anecdotes related to the contents of pictures which would serve as the preamble for an ensuing plot. This plot would pose an enigmatic problem that players need to solve in order to advance to further stages of the game. For that purpose, the memories would contain clues to help unraveling the mystery. These clues, however, would normally be hidden at first glance. Thus, players would feel compelled to interact, in one way or another, with the memories to uncover the clues. For instance, some memories could be scrolled or scaled within their corresponding frames as to reveal concealed details or pieces of information. Alternatively, the player could interact directly with objects portrayed in the memory; in the Figure 3.3, for example, the player could try out opening combinations at the lockbox portrayed in the rightmost-bottom memory [1].

Figure 3.3: The stage after developing a few more memories.

The last part of the concept added even more elements to an already intricate game idea. For instance, that a sinister creature would, in due course, start hindering the progress throughout the game by consuming some of the memories already produced by the players. The creature would manifest within the frames and wipe off memories from the stage in its path (Figure 3.4). Moreover, the concept proposed the idea of collectible items or supplies that would be gathered by players throughout the game and could be used to unlock other, yet undefined, features in the game.

[1] This portion of the concept is inspired by the game *Device 6* (Simogo, 2012), in which text, images and sound are exceptionally combined to support the events narrated in a text-based story. In Device 6, images move within their viewports as the player scrolls across the text. Depending on the scrolling position, players will be able to see previously concealed parts of the pictures, which often contain hints to solve puzzles. In Device 6, solving these puzzles is a requirement to unfold the ensuing events in the story.

Figure 3.4: An undesirable resident would also dwell in the memories.

Figure 3.5: Tools and supplies would be collected to aid the production of memories.

In retrospective, this concept did not address well the most essential elements of the game, and instead become lost into the details. Particularly, the mechanics to produce the pictures remained ill-defined while, as I mentioned earlier, their design should have been the focus of attention. The implications of this design gap would trickle down over an ensuing, protracted concept design phase. There, I would struggle to design suitable mechanics to develop the pictures that could still be integrated well with the rest of the ideas proposed in this first concept.

3.2 Concept design

The first concept described in the previous section was presented and endorsed unanimously by the team. On the surface, it certainly looked appealing, however, it teemed with design gaps and shortcomings. Hence, I would start to immediately ameliorate these issues by focusing on the way in which players would exactly produce the pictures, and how the overall flow of this process would be experienced by them.

Along the way, however, I would keep stumbling upon the obstacles the design restrictions I imposed over myself with the first concept. Namely, I intuited the need to convey better the basics of photographic processing, for they were somewhat relegated to a subsidiary theme in my initial designs. However, this idea of the *memory* would start to sabotage my attempts to concoct a more suitable photographic processing flow in the game. For two reasons. First, because the *memory* neglected the paper (or film) in the first place, which is essential to the physical picture. Second, because the idea of disguising game stages as darkrooms (when switched into the *dark mode*) and developing these memories on-site, right into the frames, was also neglecting the idea of the *darkroom* itself; being the exceptional, unique place where this entire, remarkable process occurs. Turns out I was failing to look after some of the most important elements of the underlying theme.

As a consequence, I would conduct a reversal in my approach toward the theme to redesign the game concept almost entirely. From this point forward, the pictures would not be developed on-site anymore. Instead, the frames would act as access points to the pictures that in turn would be developed, not surprisingly, in a *darkroom*. To this end, I started visualizing the rooms as part of a bigger structure, somewhat like a *mansion*[2]. Consequently, this mansion would accommodate a *darkroom*, which was initially located at the basement of the structure.

[2]In fact, this building was originally referred to as the "museum"; for it would implicitly allude to the Finnish Museum of Photography. At the same time, there were ideas about making the virtual museum look like the real one, as to bring kids into the realization that the FMP was an actual place where the fantastic events portrayed in the game take place. This idea was soon deemed unconvincing and far-fetched and therefore dismissed. Later on, we would look for alternative names to also incorporate as part of the game's name. The idea of the *mansion* appeared suitable and was soon taken into use. For disambiguation, I will always refer to this game element (the environment) as the *mansion*.

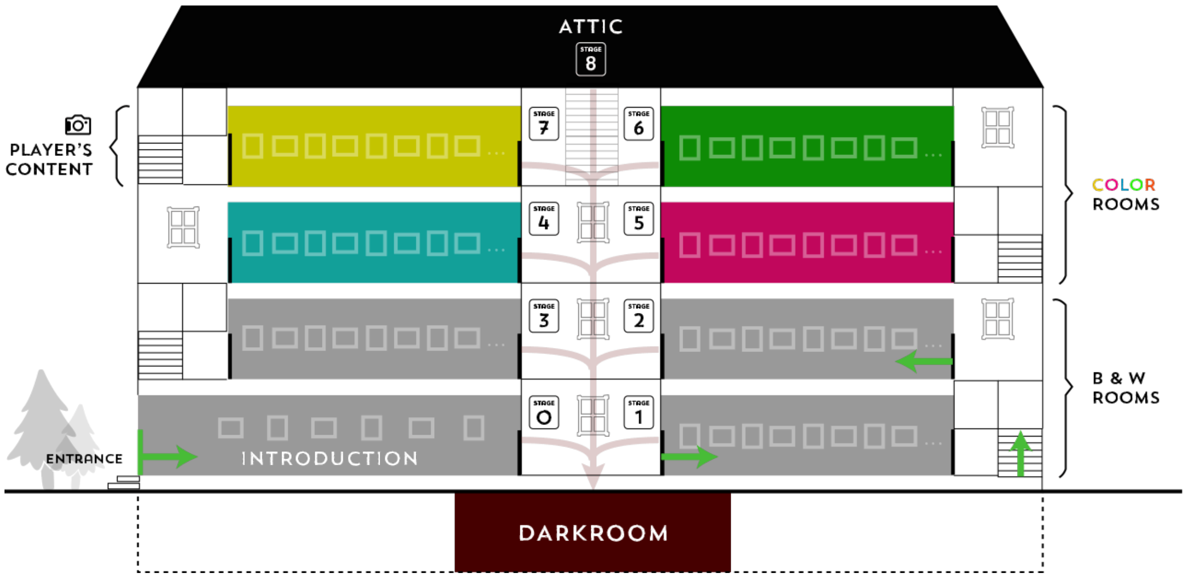

Figure 3.6: The original blueprint for the *mansion*.

The Figure 3.6 shows the preliminary design for the mansion. From the figure, it can be interpreted that the mansion would exhibit framed pictures across multiple rooms. The figure also hints at different types of rooms that might contain only either black and white pictures, or colored ones, or pictures taken by the player herself. Pictures for the former 2 categories would be all artworks produced by Finnish artists in the darkroom, and taken from the archive at the Finnish Museum of Photography. The distinctive look of these pictures[3] inspired an alternative classification based on the theme, setting or mood portrayed by the picture. This idea would lead to a ragtag set of categories such as *summer of love*, *adventure*, *winter*, etc., each of which was assigned to a different room[4].

The structure would be navigated, or rather scrolled through, by sliding a finger over the touchscreen. Technically speaking, the players would be in fact moving the game's camera with the finger, which in turn would cause the screen to display different parts of the structure. At first, the camera would be placed by the main doors, outside the mansion from where the player would start the exploration toward the darkroom. Along her path, the player would become acquainted with the frames, originally empty, to which they would return after developing a first picture in the darkroom.

Once in the darkroom, players would be induced to interact with the *enlarger*[5], which would take them to an alternative *mode* in the game where they would process their

[3]Due to the wide range of techniques employed in the making, as well as the state of the art in which they were produced.

[4]These categories would also inspire structural changes to the mansion in order to liven up the rather monotonous layout of the structure. Similarly, we would decorate the rooms according to their underlying theme in an attempt to provide an ever-changing atmosphere.

[5]The apparatus to enlarge or reduce the negatives that will be projected on the photographic paper, during the *exposure*.

first photograph. This *mode* was planned to look like a close-up view of the tools and otherwise the processing area of the darkroom.

The Figure 3.7 shows a close-up view of the enlarger by which the player would expose the image to process. From the selection menu shown in the figure, the player will choose an image[6] and trigger a game mechanic that would transform the exposed paper into a *game board* (Figure 3.8). The board would support an arrangement of tokens that the player could manipulate to develop the picture. It was only until this point in the design process where the photographic processing started to be regarded as a system of *puzzles* in the game. The goal of each puzzle would therefore be to develop a picture successfully. The subsection 3.2.1 will describe in detail the subsequent steps taken to devise an interesting set of puzzle mechanics with which to develop the pictures.

Figure 3.7: A negative being projected on a surface by means of an enlarger that is looked at from above. The player would choose the image to expose from the selection menu displayed at the top.

[6]The idea of choosing the image to process was rooted in a later dismissed feature in which players could arrange the pictures in the rooms according to their preference. The motivation behind this feature was to allow players to "curate" their own in-game photographic collection.

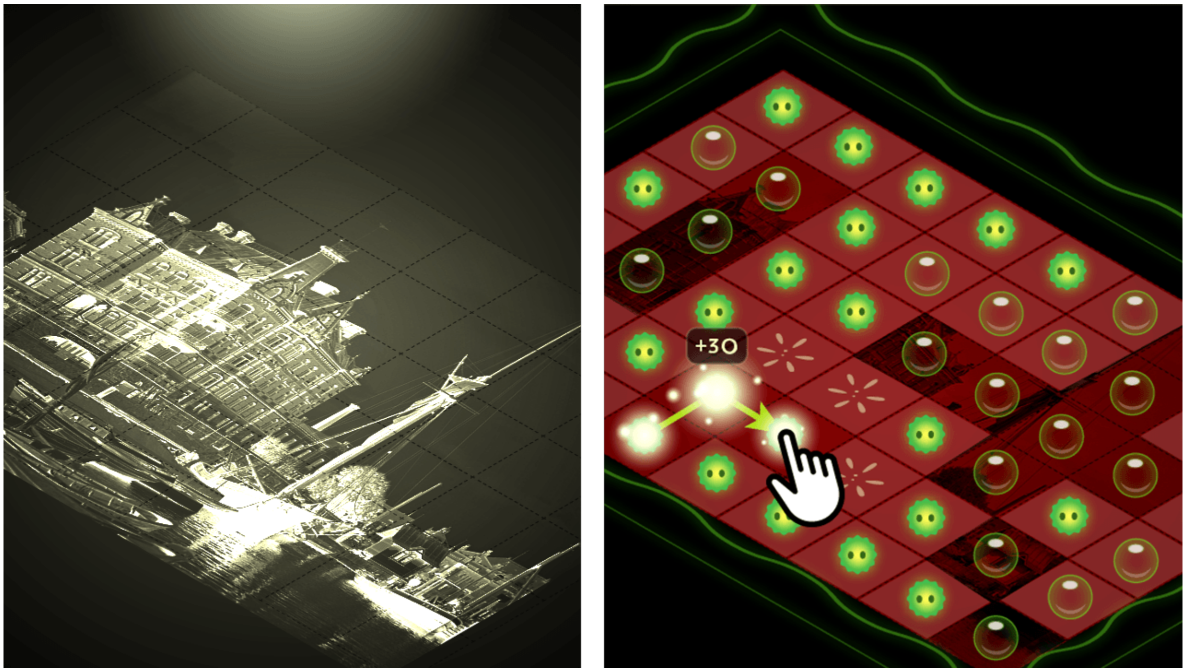

Figure 3.8: After an image is selected, the game would play an animated sequence in which a sheet of (photographic) paper is tossed into view and "exposed". Next (on the right), the scene transitions into the *development puzzle* where the paper serves as a *game board* and the player uses the *chain-matching* mechanic (Figure 3.9) to develop the picture.

Meanwhile, this new take on the concept seemed to improve on the weakest points identified in its predecessor. Or at least, the rift between the game and the theme started to narrow. Most of this narrowing was accomplished, however, from the aesthetics point of view. Back then, I tried to visualize how the players would perceive the environment, how they would interact with the frames, and how the game would eventually handle the transition between the *exploration* and *puzzle-solving* modes. As a result, I solved several functional questions that were carried over from the initial concept. This user-centric approach is something that I would only later recognize as a distinctive trait of the game's design process.

3.2.1 Puzzle mechanics

Designing "fun" and at the same time meaningful mechanics for the puzzles was undoubtedly the most difficult challenge I faced during the design process of the game. Part of this process I would spend skimming through articles and books about the darkroom and the principles of chemical-based photographic processing. Thereby, I learned about the chemical interactions occurring between the paper (or film) when subjected to light during the exposure, and later with the variety of chemical agents used to develop and fix the picture. I would also expand my grounding by learning how the multiple image filters and effects, now available in broad selection of digital image edition tools, have their roots in the traditional photographic processing[7]. With this knowledge in mind, I started to devise some of the following alternatives for puzzle mechanics.

Back then, I saw potential in using the fundamental chemical interactions between the paper and the chemical agents as the core puzzle mechanics. For that end, the chemical agents involved in the processing were represented by means of tokens on the board, which soon began to be referred to as the *puzzle agents*.

At first, I would focus strictly on the development phase, where the latent image is revealed. Clearly, this phase comprised the highest aesthetic potential as it was analyzed in the section 2.3. The Figure 3.9 describes one of the first alternatives for development mechanics. This mechanic was solely based in the chaining of contiguous like agents on the board. Chaining these agents would enable a development reaction that resulted in 2 complementary puzzle dynamics. First, the sections of the board underneath the reactant agents would become developed, and occupied by bubbles. Second, the bubbles in the vicinity of the reaction would pop and give way to new agents. Ideally, the strategic chaining of agents would eventually produce the entire latent image. Additionally, the process would be time-constrained and there would be ancillary dynamics to reward long or special development chains.

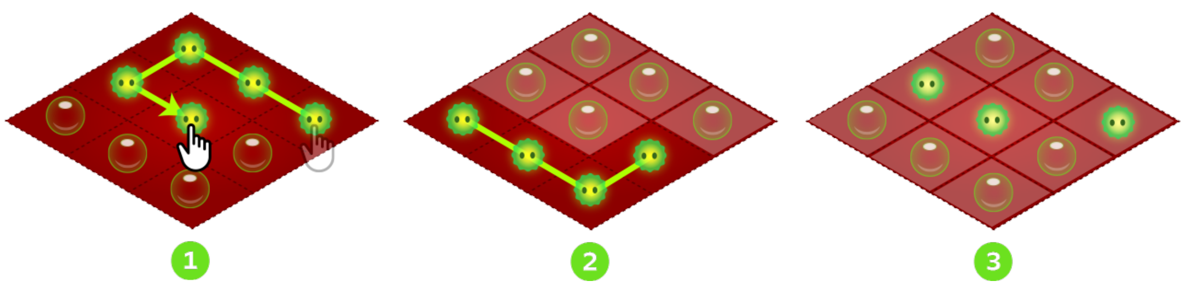

Figure 3.9: *The chain-matching mechanic*: (1) The player taps and slide a finger over contiguous agents to chain them. (2) Upon releasing the finger, the chained agents react and thus produce the underlying sections of the image (shown highlighted). Additionally, the freed sections on the paper are now occupied by bubbles. Conversely, other bubbles in the vicinity of the reaction burst and new agents emerged in turn. (3) Another chained set reacted and produced the remaining sections of the latent image. Invariably, sections on the paper where a reaction took place give rise to new bubbles, whereas bubbles in the vicinity of the reaction give way to new agents.

In the following section, I will explain the digital prototype built to evaluate these mechanics, and the conclusions derived from this experience. Meanwhile, I will describe other mechanics designed to compensate some of their deficiencies; namely, the lack of challenge and its overly deterministic nature.

[7] This is an assumption I would partially verify when comparing the results of different picture manipulations achieved through a wide range of processing techniques (Langford, 1984, pp. 180-329).

In response to the lack of challenge, I instinctually introduced 2 new kinds of agents. At that time, my plan was to enable the chaining only among agents of the same kind. Therefore, having 3 kinds of agents on the board would somewhat restrict the chaining leeway. Next, I started to visualize new relationships among these agents. Among those, I saw potential in *clustering* those of the same kind (Figure 3.10) and *grouping* those from a different one (Figure 3.11). Similarly, the idea of *group clustering*, in which like agent groups could be clustered, seemed worth trying (Figure 3.12). Moreover, I contemplated the alternative of enabling the development reaction only if the 3 kinds of agents were present in a chain[8].

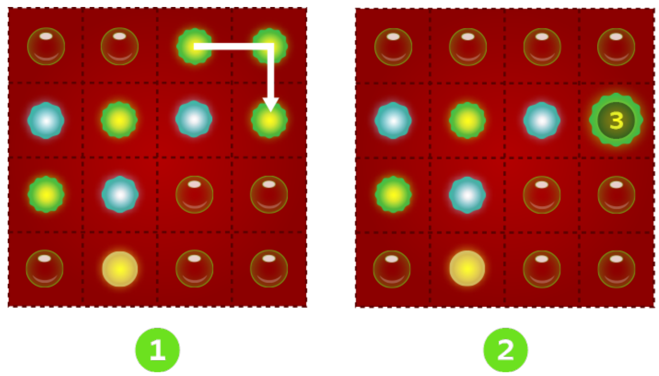

Figure 3.10: *Agent clustering*: (1) Three like agents are being chained. (2) The chained agents become clustered into a single unit that is worth 3 individual agents. Once formed, the cluster remains in the location of the last chained agent. Additionally, bubbles are spawned on the paper sections previously occupied by the now clustered agents.

[8] This idea of a compound reaction was in line with the composition of a real photographic developer which is usually a mixture of at least 3 main components: (1) the developing agent itself, (2) an alkaline agent, and (3) sodium sulfite (Wall, 1889, p. 38).

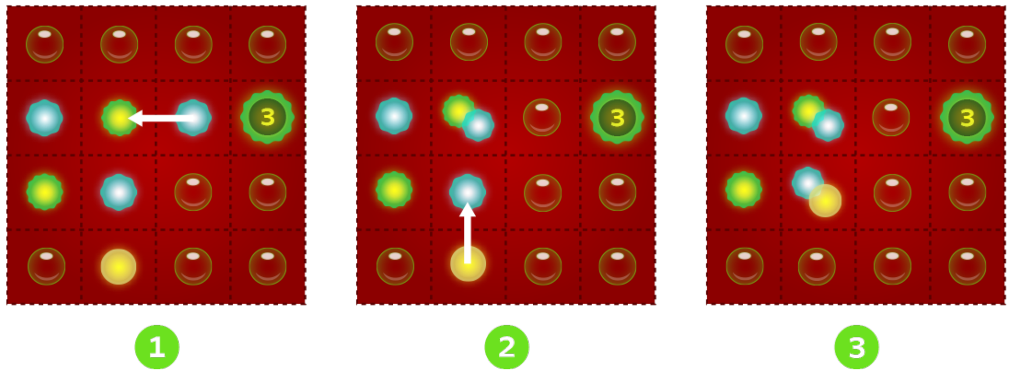

Figure 3.11: *Agent grouping*: (1) Two unlike development agents are being chained. (2) A group is formed and placed at the location of the last chained member. Similarly, another pair of unlike agents are being chained below the first group. (3) A second group was formed, one of a different composition than that of the former.

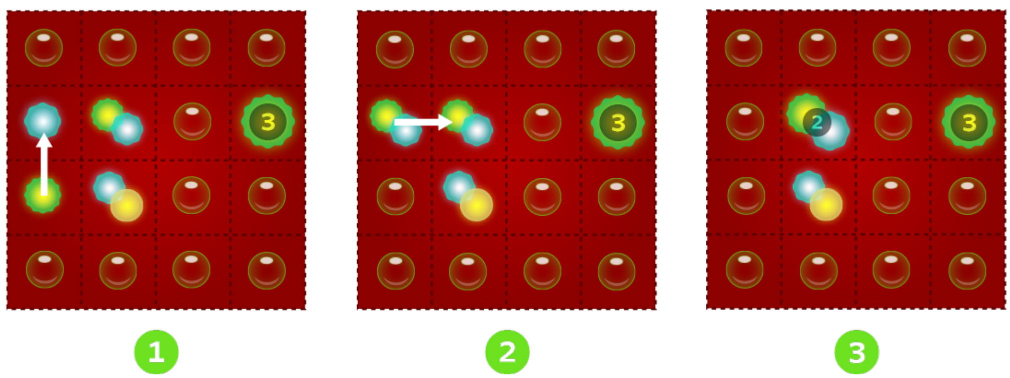

Figure 3.12: *Group clustering*: (1) A pair of unlike agents are being grouped. (2) Two like groups are being chained. (3) The like groups are now clustered into a *group cluster* that is worth 2 individual groups.

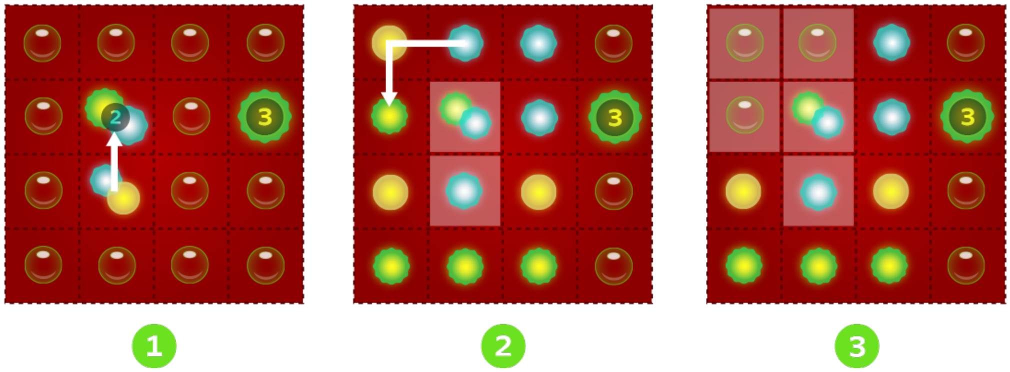

Figure 3.13: *Compound reactions*: (1) Two unlike groups are being chained. (2) A development reaction took place because members of every agent kind were chained. As a result, the underlying sections of the image are revealed (highlighted). Similarly, 3 individual unlike agents are being chained. (3) A second reaction took place correspondingly revealing sections of the latent image. Once again, sections on the paper where a reaction took place give rise to new bubbles, whereas bubbles in the vicinity of the reaction give way to new agents.

3.3 Prototyping

This section summarizes the most significant prototypes developed to validate some of the design ideas already described in earlier sections. All of the presented prototypes will be digital ones, and therefore explained by means of screenshots taken from their actual implementation. Nearly none paper prototypes were produced for the game, except for partial attempts that did not yield any valuable insights. For that reason, these inconclusive attempts are excluded from this account.

With hindsight, the proportion of digital vs. non-digital prototypes produced for the game should have been more balanced, or rather leaned toward the non-digital side. The development of digital prototypes took a considerable portion of production time away from an already tight schedule, and yet not all of them were truly necessary. Some of these prototypes could have been easily replaced with non-digital counterparts, and I could have obtained equivalent results in just a fraction of the time. This already represents a valuable lesson drawn from my work in Darkroom Mansion.

3.3.1 The puzzle mechanics

The earliest prototype deals with some of the ideas from the *first concept*. At that point, I was still exploring the possibility to carry out the picture processing within the frames. The Figure 3.14 shows how the prototype played with the idea of *exposure* within the frame. In the figure, hollow white spots representing the *exposure targets* are being exposed by *light orbs* that move haphazardly over a reference grid. In the prototype, the light orbs can be collected with the finger and placed in the remaining unexposed targets. After all of the targets are exposed, the prototype transitions into the *development* phase shown in the Figure 3.15.

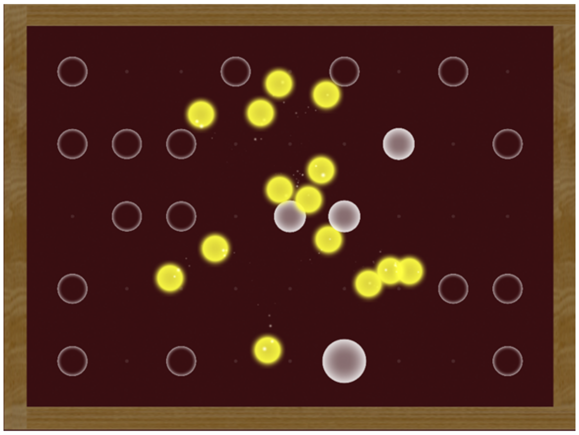

Figure 3.14: *Exposure*: *Exposure targets* (hollow white spots) are laid on random locations on a grid. *Light orbs* (yellow blobs) that were tossed into the play area are moving haphazardly within the frame. Some targets are already exposed (filled white spots) upon coming in contact with the light orbs. The light orbs can be also collected by tapping or simply sliding a finger over them. Then, the remaining inactive exposure targets can be manually activated also by tapping or sliding a finger over them.

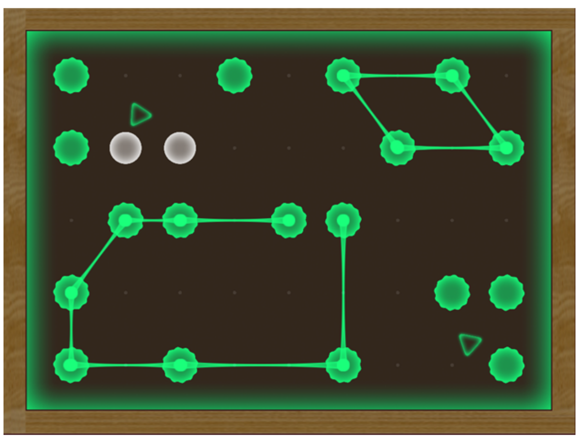

Figure 3.15: *Development*: The *development agent* (green triangles) can be as well collected with the finger and used to infuse the exposed targets. As a result, the infused targets (green, dented blobs) can be bonded to one another. The bonds are established by tapping an infused target and sliding the finger until coming in contact with another.

The functionality described in the Figure 3.15 came to be merely a toy to visualize the *bonding*[9] mechanic for the picture development. Although this prototype did not get to validate the mechanic it was intended for, it inspired important design decisions. On the one hand, it served as the basis to concoct the *chain-matching* mechanic (Figure 3.9) and its subsequent variants. On the other hand, this prototype revealed the inconveniences of processing the pictures on-site, from within the frames, and provided the grounds to move into the formulation described throughout the section 3.2.

As I described earlier, such turnaround was rooted in the desire to closely model the puzzle mechanics after the actual photographic processing. The Figure 3.15 already hints

[9]The *bonding* was an early puzzle mechanic in which the player would use the chemical agents to establish bonds between the exposed *silver halides* in the photographic paper, rather than establishing links (to trigger reactions) between the chemicals themselves. This idea was fleeting for it did not prosper, and only its corresponding (albeit unfinished) prototype is covered in this document due to the valuable design insights derived from it.

at the idea of a *developing bath*[10] in which the developing agent can be interacted with. Suddenly, it appeared preposterous for this entire process to occur within an ordinary photographic frame, and therefore I stopped daydreaming about ethereal mechanisms to process the infamous *memories* (Figure 3.2).

An ensuing prototype tackled the *chain-matching* mechanic described in the Figure 3.9. The Figure 3.12 describes a screenshot of the prototype in which the mechanic was implemented faithfully. This prototype was subsequently playtested, within the team and outside it, and found to be inadequate. Mainly because the mechanic offered none to very little challenge for the players to develop the picture. Rapidly and conveniently the players would develop all of the squares in the paper. Clearly, the lack of rules around the chaining allowed an excessive amount of freedom in the game. In like manner, there were no other mechanics to create tension in the game, such as time constraints or counteractive tokens in the play area.

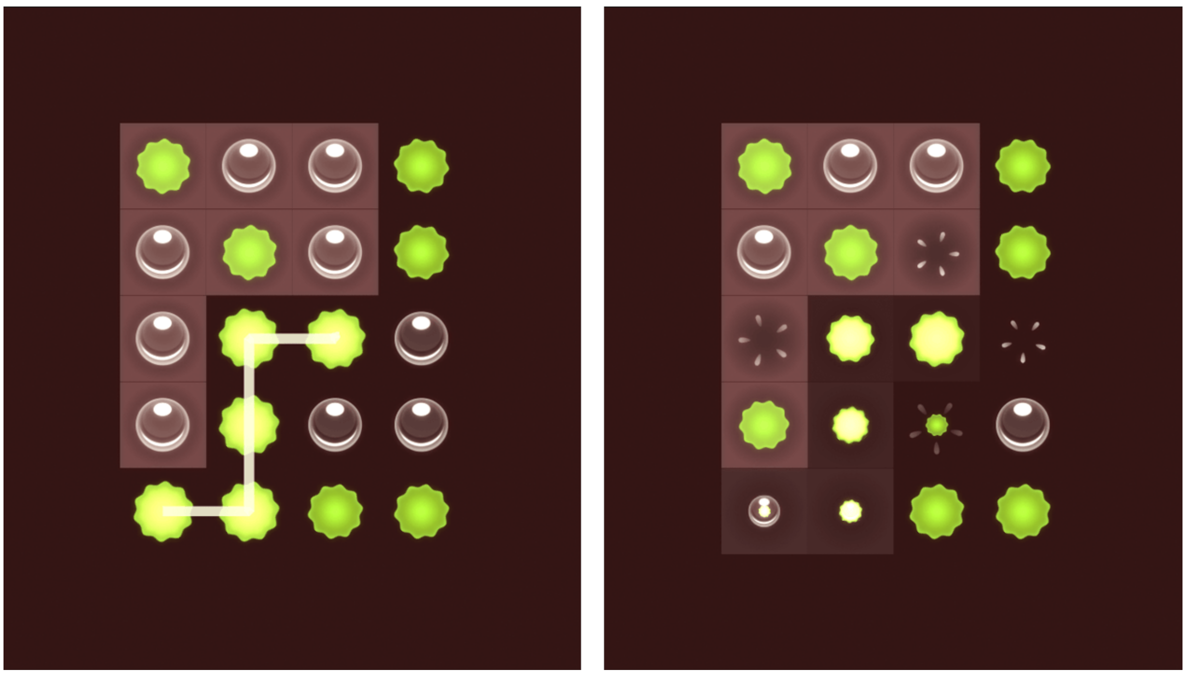

Figure 3.16: *First iteration of the chain-matching prototype*: the development agents (green, dented blobs) can be connected with the finger to enable a development reaction. The resulting developed sections of the picture are shown highlighted. After developing all of the sections in the paper, the prototype would automatically assemble a new configuration to play. The size of the play area, as well as the arrangement of agents and bubbles on it, was all randomized.

These finding motivated the proposal of the *chain-matching* variants and additional

[10]A container (usually a *developing tray*) filled with developing agent into which the exposed paper is immersed to be developed. In the Figure 3.15, the frame resembles a developing tray looked at from above. This alternative interpretation also motivated the transition of the puzzles into an independent, more processing-centric setting.

mechanics described from the Figure 3.10 and all the way to the Figure 3.13; the majority of which would never be prototyped. At some point during the discussions held with Stefan Engblom about the potential of these mehcanics, we agreed that they were overcomplicating the goal of the puzzle without adding much value to the experience. In fact, through them the development was becoming more of a chore than a feat. As a result I would abandon these ideas after pursuing only a few variations of the original *chain-matching* mechanic.

The Figure 3.17 shows a later iteration of the *chain-matching* prototype in which several new elements had been incorporated; including 2 new kinds of agents, a play area split into hexagon-shaped rather than square sections, and locked sections on the paper on which no token could be placed or moved through. In combination, these features indeed made the prototype more interesting to play, but nothing near exciting nor rewarding. Once again, I was solely focusing on adding innate complexity while paying little attention to the aesthetics of the experience. For instance, the game remained entirely deterministic, for the outcome of every move was completely predictable, and therefore there was no element of surprise and little emergent complexity to enable it.

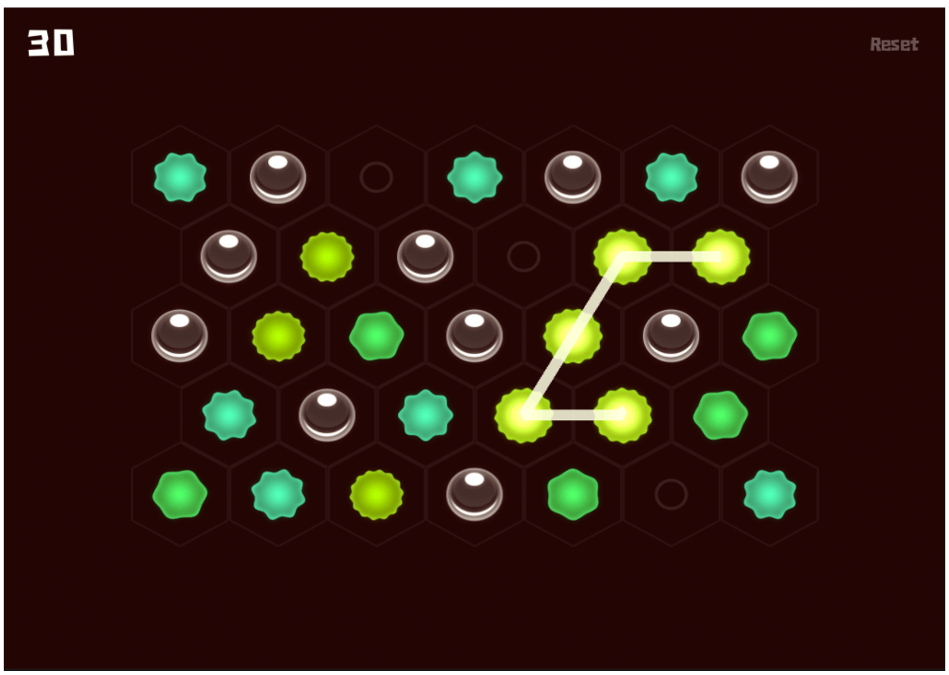

Figure 3.17: Later iteration of the *chain-matching* prototype. In this version, the chaining was limited to like agents only, and the play area was split into hexagon-shaped sections in response to the increased complexity to accommodate suitable chains. Ironically, some sections were locked (empty ones marked with a circle in the middle) to once more restrain the excessive level of freedom afforded by the adapted layout.

From this point forward, I would abstain from sketching new alternatives for the yet inconclusive puzzle design. Instead, I would try new ideas directly into digital prototypes. As earlier attempts confirmed it, certain dynamics and aesthetics of the game could only be verified by way of play[11]. The following prototypes will be described briefly by means of screenshots taken from their actual implementation.

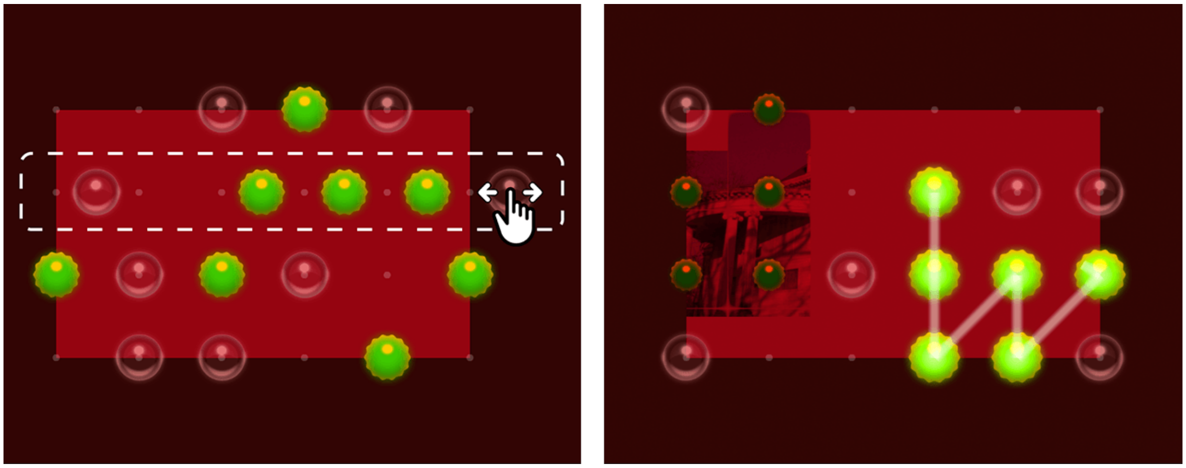

Figure 3.18: *Line-displacement* prototype: on the right, a full line of tokens is displaced on the board with the finger. Tokens surpassing the boundaries of the board on the side toward which the displacement is directed are removed from the tip of the line and appended to the opposite end of the line. On the right, agents still need to be chained in order to develop the picture.

The Figure 3.18 describes a prototype in which entire lines (rows or columns) on the board could be displaced with the finger. As a result, the tokens going past the boundaries of the board would be appended to the opposite end of the line in relation to the direction of the movement. Back then, these mechanics seemed like a potential ground for dynamics to thrive but unfortunately they did not work well in combination with the chaining mechanics. In general terms, it turned out tedious to first “congregate” the agents in an arrangement such that a striking chain reaction could be effected. This preparation work prior the chaining appealed to be challenging but the subsequent mechanics to develop the picture remained as deficient as before.

[11]This is *iterative design* at its best. As Salen et al. put it "iterative design is a play-based design process" that emphasizes prototyping and playtesting to design a game based on the experience of playing it (2004, Chapter 2).

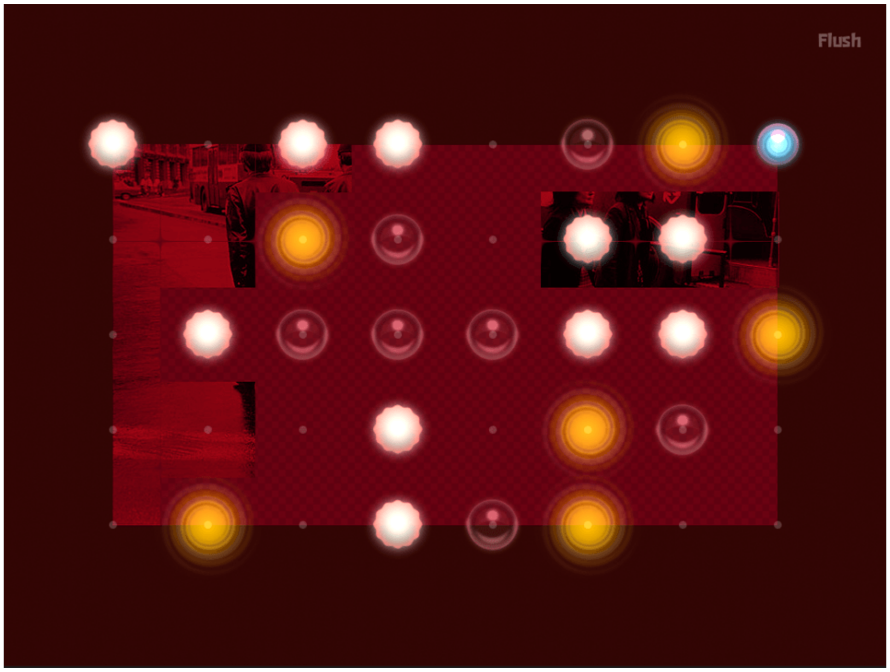

Figure 3.19: *Line-displacement 2.0* prototype: All tokens on the board can be displaced except for the acidity pits (fire-like spirals). Should agents come in contact with the acidity they will be destroyed. To prevent this the pH-regulator (blue orb) could be used. Additionally, agents (white dented blobs) would not need to be chained any longer to create to enable the development reaction. Instead, swiping one agent toward another would automatically trigger a reaction that extends through all of the contiguous agents on the board.

Later on, I tried to enhance the *line-displacement* prototype by (1) adding tokens with special mechanics and (2) removing the chaining altogether towards what I believed was a simpler matching mechanic. On the one hand, the Figure 3.19 shows 2 new types of tokens on the board. One that looks like fire vortex which was meant to represent the acidity of the developer, the other is a blue orb which was meant to act as a pH-regulator and with which the acidity could be regulated. This idea already sounds contrived but I was then trying (desperately) to come up with interesting ideas to spice the puzzle up. Therefore, during the line displacement, the acidity would always remain in place and destroy the agents (white dented blobs in the Figure 3.19) that would come into contact with it. To prevent this, the pH-regulator could be displaced toward the acidity in order to neutralize its effects.

On the other hand, the chaining was removed from the prototype so that alternatively, after as many agents as possible had been assembled by means of line displacements, one of them (any) could me swiped toward the others to trigger the development reaction. In consequence, all of the contiguous agents would react and develop their underlying sections in the picture. Notoriously, after building and playtesting the prototype I could evidence how contrived and unintuitive these mechanics are. And despite they gave room for some interesting dynamics to take place, these did not justify the further exploration of the displacement mechanics as a whole. Clearly, something was missing and I had not been able to connect the dots in all the design work made to that point.

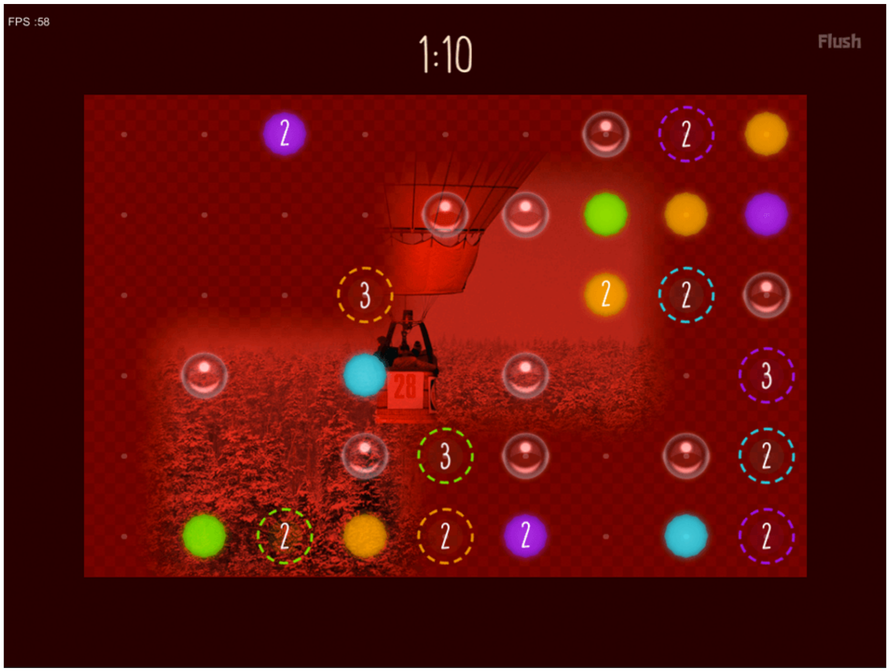

Figure 3.20: The final puzzle prototype on which the puzzle mechanics for Darkroom Mansion were based.

At last, the ultimate puzzle mechanics came to me as compilation of the best ideas from all of the previous design attempts. The Figure 3.20 shows the prototype in the condition is which it was playtested with children to validate the mechanics. These mechanics were incorporated almost exactly as they were conceived into the final puzzles. The section 3.4 describes, however, a few notable iterations made based on puzzle dynamics witnessed during playtesting. The *exposure* stage in the puzzle came as a byproduct of this prototype due to the apparent thematic connection that could be established among the *targets* on the board (Figure 3.21). This connection supported an interesting mechanic in which the "unexposed" targets would not be available for development. This situation would result in interesting dynamics such as that the player would replay the exposure stage before moving further in the puzzle lest the entire picture could not be developed.

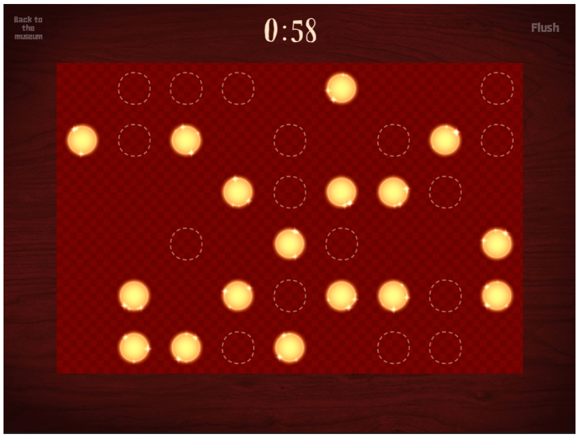

Figure 3.21: The *exposure* stage in the puzzle, as it was initially prototyped. This stage came as a byproduct of the initially crafted development stage. The mechanics resulted fitting for both processing stages for targets on the board were associated with the molecules of *halide* that both light and developer agent interact with in order to produce the visible image.

3.3.2 The mansion

This subsection offers an overview of the evolution of the mansion along several stages of development. Some of these iterations reflect important design decisions that will be described along the way.

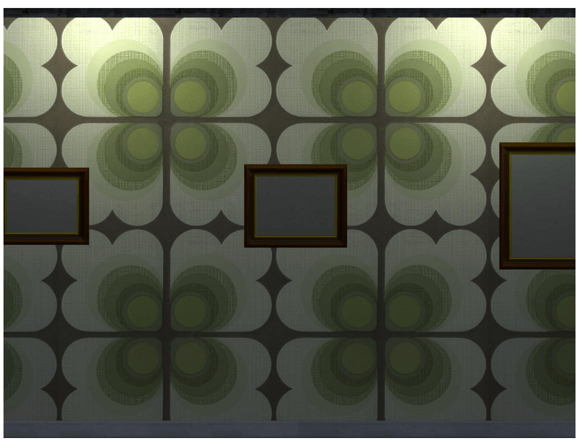

Figure 3.22: Interior of a room in the mansion rendered using an orthographic projection.

As it was initially planned, the rooms representing stages in the game would simply be scrollable planes in which the pictures would be interacted with as thumbnails on a webpage or image gallery (Figure 3.22). However, the uninspiring results motivated the exploration of more interesting alternatives for which the perspective projection shown in the Figure 3.23 seemed fitting.

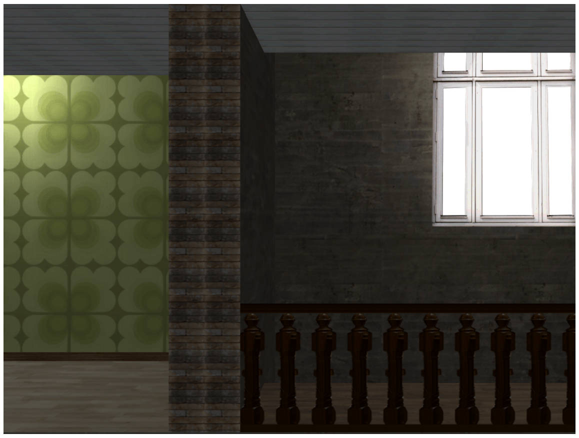

Figure 3.23: Interior of the mansion in perspective.

As described in the section 3.2, we would progressively move toward the design of a comprehensive 3D environment in which the rooms would be connected as part of a bigger structure. The mansion, therefore, started to take shape after a brief prototype built based on the original mansion blueprint (Figure 3.6). However, the later thematization of the rooms inspired a redesign of the structure in order to reflect the variety of narrative themes of which the space was going to be composed. The Figure 3.24 shows the first mansion structure. Additionally, the Figure 3.25 hints at the provisional arrangement of themes and pictures along the structure.

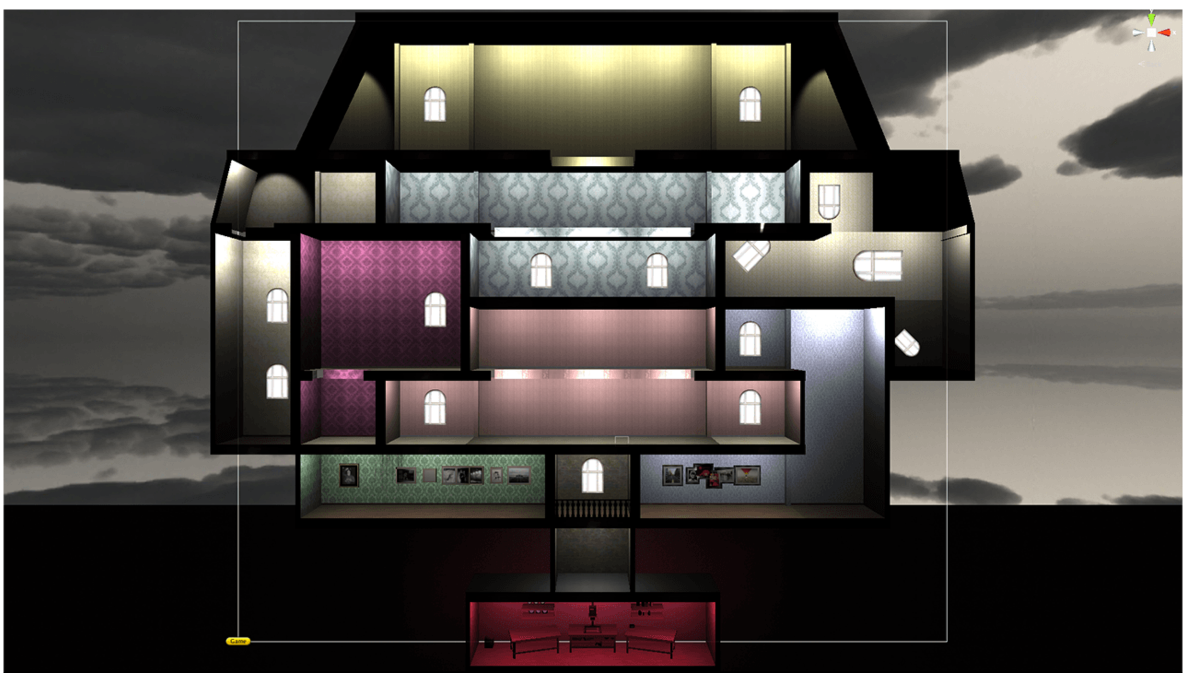

Figure 3.24: The structure of the first mansion as captured from the Unity® Editor.

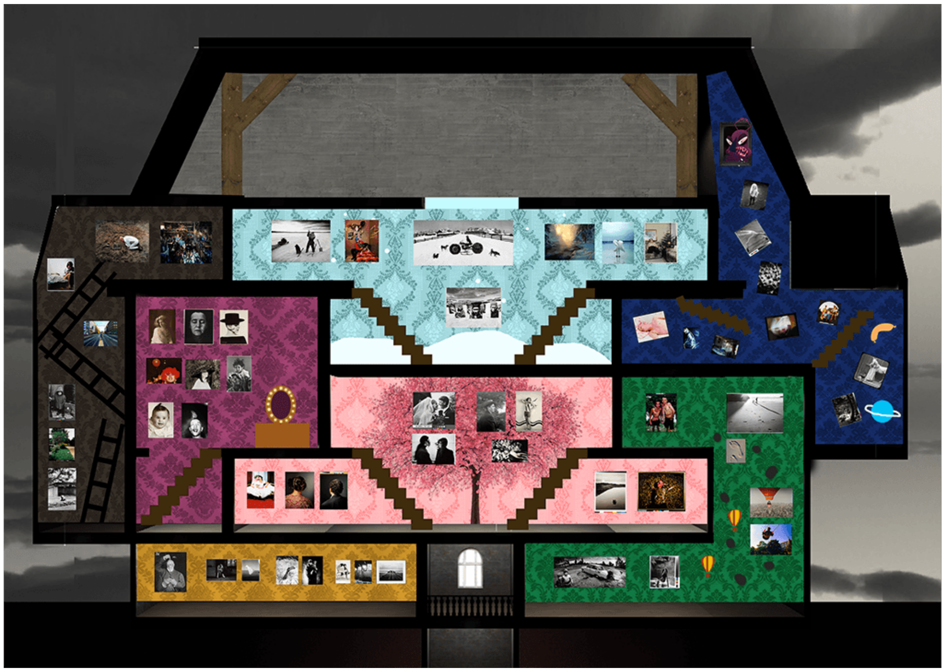

Figure 3.25: Sketch of the thematized rooms in the mansion hinting at their appearance and the optional arrangement of the pictures in them.

The Figure 3.26 shows a more enhanced version of the mansion in which rooms are already decorated according to their theme. At some point, however, I would face technical constraints that prevented the use of most of these 3D ornaments in the game. Some of which had been acquired from the Unity® Asset Store and happen to not being adequate for mobile development; at least, when used in combination, they were pushing the devices on which the game was run to the limit. This situation was worsened by the poor use of lighting and materials in the scene. Later on, the situation would improve as a result of the application of multiple optimization techniques that made possible for the game to run smoothly and look better than ever in every supported device in which it was tested.

Figure 3.26: A more advanced mansion in which the rooms were decorated according to their theme.

The final version of the mansion (Figure 3.27) features a different structure in which the darkroom is more central. Additionally, the rooms are no longer connected into single sequence but they can be reached quicker and more conveniently from any other location in the mansion.

Figure 3.27: The final version of the mansion: in this version, the structure was once more redesigned to raise the importance of the *darkroom* (dark blue room) in the mansion. The red, green and blue lines that are drawn along the divisions of the rooms and outline the structure of the building are the navigation limits, as rendered by a custom Editor Component.

3.4 Continuous design

In this section, I will describe a few additional design instances that helped shaping up the game, particularly the puzzles, to their final form.

3.4.1 Procedural puzzle generation

The token generation for all the prototypes developed so far had been randomized. At the point when we decided to start producing the final puzzle design we thought we would need to manually design the levels for it. However, doing that represented a significant amount of work for which did not have time due to the tight schedule. Instead, I decided to make the puzzles content still randomized but somehow give the appearance that it had been predesigned. For this purpose, while programming the puzzles, I would make use of a behavior in the `Random` class[12] in C# by which "[i]f the same seed is used for separate Random objects, they will generate the same series of random numbers. This can be useful for creating a test suite that processes random

[12]Part of the Microsoft® .NET Framework 2.0 subset supported by the Unity® version (5.3.4f1) used to produce the game.

values, or for replaying games that derive their data from random numbers" (Microsoft, 2018). Thereby, I could create pseudo-random numerical sequences that would be the same on every copy of the game. Consequently, I used this approach to feed certain custom-made algorithms which will output the different arrangements of tokens and targets on the board for every puzzle, provided that they would be the same for every player regardless of the platform or device on which they played the game.

3.4.2 Agent design

After testing the "ultimate" prototype we proceeded to improve on a smattering of its playability issues, the majority of which revolved around insufficient visual association. In the prototype (Figure 3.20), the agents can only be differentiated by color, for the shape and size is for all the same. Likewise, their corresponding targets on the board can be only distinguished by color, provided that their numbers already match. Even worse, the targets used in the prototype are merely dashed circle outlines, among which the color is even less discernible. As a result, players needed to pay special attention before locating suitable targets on the board. And well, color blind people would be completely oblivious to potential mismatches.

To improve the situation, we would start experimenting with attributes of shape, size and layout (in addition to color) to impart an unmistakable look to each kind of agent. Salla and I would brainstorm about different combinations of said attributes, and would even experiment with facial features for the agents. The results from these visual experiments are compiled in the Figure 3.28.

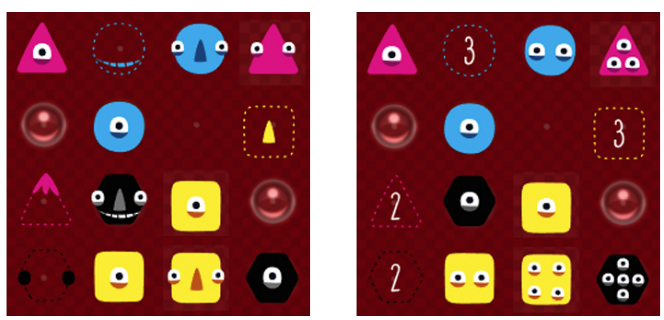

Figure 3.28: A compendium of alternatives to represent individual agents and agent clusters in the puzzles. On the left, a variety of facial feature combinations for agents and agent clusters alike. Their corresponding targets would display the same features. On the right, a similar scenario where only eyes are used to indicate the worth of the agent or cluster. Similarly, the targets use colored spots to indicate their worth. *Artwork by Salla Vasenius.*

The facial feature matching seemed appealing at first glance, until we became aware of its implications. Basically, the use of facial features would shift the entire puzzle mechanic from simple clustering or accumulation of agents into a matter of facial feature permutation. Besides, the instinctive visual association that we were after in the first place did not feel any better. On the contrary, there were now more complex elements to decode before creating mental associations. As a result, we pursued eye-based alternative shown in the Figure 3.28.

Later on, during the subsequent implementation of these improvements, we would also pay special attention to the arrangement of these *spots*[13]. Back then, I was under the assumption that such arrangement could also help enabling rapid mental associations with the represented value[14]. Therefore, we arranged the spots in accordance with the visual representation of values in a regular 6-sided die; with the exception of the number 3, for which we instead used, due to aesthetic reasons, a triangular representation. Later on, we would validate this assumption via playtesting. To our satisfaction, the application of all of the aforementioned visual association strategies would improve drastically the playability of the puzzles.

Another interesting playability issue detected in players was about the tendency to accumulate the highest count of like agents before paying any attention to the targets marked with equal or lower numbers. Inevitably, the presence of numbers seemed to prime certain players to score the highest count, or instead to simply follow the numerical sequence. Only until realizing that there were no more matching items to pursue, these players would start looking for other playing possibilities on the board. Even though we explored alternatives to retain numbers to represent the agent and target worths, we would dismiss them after recognizing the potential of the spot-based representation model. Unknowingly though, after removing the numbers we solved the issue fortuitously. During future playtesting, we would no longer witness this counterproductive behavior in players; if so, only momentarily and to an inconsequential degree.

In time, other less critical playability issues were also improved. Particularly, the seemingly insufficient visibility of targets, for which their dashed outlines would be animated as if moving along the contour path. Others, such as the possibility to move bubbles across the board, would be tackled with subtle animations that hinted at the desired player response.

[13]The eyes of the agents and spots in the targets regarded collectively.

[14]This category of almost effortless mental associations is what Daniel Kahneman (2011, pp. 50-58) elucidates as an essential trait of our intuition (System 1).

4 Postmortem

Hopefully at this point the readers already have clear picture in mind about the structure and aesthetics of Darkroom Mansion, as well as about the design process behind their development. This chapter will focus on pinpointing the most meaningful aspects that went right or wrong during the development process of the game, as whole. Some of these development aspects will fall into the categories identified by Sathiyanarayanan et al. as "as common aspects of things that go right or wrong for teams during game development". Such categories are derived from "155 retrospective postmortems published on Gamasutra.com over 16 years. These postmortems cover games for PCs, mobile devices, and consoles and range from small independent efforts to large AAA game franchises" (2016).

4.1 What went right?

4.1.1 Game design

The game design went right insofar as it resulted in an appealing and engrossing game experience for children. Part of this success was due to the iterative approach emphasized in the subsection 3.3.1 with regard to the design of the puzzle mechanics. Back then, the continuous prototyping and subsequent playtesting were key not only to devise such mechanics, but to witness the puzzle dynamics and thus formulate improvements that would enhance the puzzle aesthetics along several iterations. Only through the eyes of the players we got to see what was otherwise concealed by our assumptions.

There were, however, instances in which the game design failed in its purpose to delimit the scope of the game. The subsection 4.2.2 will describe a few of those instances in which the development process as a whole suffered from my lack experience and vision in this regard.

4.1.2 Team

The section 4.2 relates some adverse circumstances under which the members of a production team would have abandoned game projects. In small teams, a similar situation could be causal for entire projects to cave in. In our case, several factors coalesced to retain the production team in full and willing to conclude the project satisfactorily. Above all, there was the possibility to publish a fully featured game globally, from which our individual portfolios would benefit greatly. Along the same lines, we were all certain about the standard that we were reaching out for. Reason for which none of us would eventually conform with features that were subpar in terms of quality. In this sense, we did not only persevere but produced the best that our individual talents combined could bring forth under the described circumstances.

4.1.3 Art

The art of the game is far from outstanding and unique, but we managed to get it right in 2 ways. On the one hand, it appeals to children and adults alike due to the combination of (1) the cartoonish but eccentric character design, and (2) the semi-realistic appearance of the mansion which was intentioned to support the innate realism of the photographs. Despite our initial concerns about a possible dissonance between these contrasting art styles, the result was cohesive and appealing to a general audience. On the other hand, the art supports well the functional aspects of the game. The subsection 3.4.2 describes, for instance, and exceptional design instance in which Salla and I would figure out how to visually convey some of the mechanics of the puzzle so that they would be intuitive and unambiguous for players.

4.1.4 Monitored playtesting

By the agency of the museum, we had the opportunity to playtest the game presently, on several occasions and with different groups of children from a variety of schools in Helsinki. These playtesting sessions were beyond useful for they showed us, clearly, that the game was "fun" to play for children. This remarkable realization would get our hopes up as a team, in a time when the development process was tuning onerous and bleak due to the lack of favorable results. Later on, these sessions would become a key mechanism to identify playability issues and verify their corresponding mending, particularly at the instances described in the subsection 3.4.2.

4.1.5 Publisher relations

The relations with the Finnish Museum of Photography were throughout transparent and understanding. Despite the outrageous change in plans and schedule, the museum was invariably sympathetic toward the product due to its proven merits.

In the common interest to validate the design, the museum would also facilitate the arrangement of the majority of playtesting sessions with children from the game's target audience. This would allow the producers on behalf of the museum to witness the evolution of the game and the positive effect it had on the children.

During the development, the communication was also efficient and appointed. Especially during the preproduction phase, we would meet regularly and presently to evaluate the latest advances toward the development of the game. Therein, we would hear their feedback and later apply the corresponding correctives for the next meeting.

4.2 What went wrong?

4.2.1 Preproduction

Probably readers have already noticed the fuzzy line dividing preproduction and production in the development process of the game. As if it was not clear enough back then, the distinction was as well hardly perceivable. It was when the mansion was being "produced" that the puzzles were just being designed. Similarly, it was when the puzzles were being "produced" that I was still designing a third puzzle stage in which the players would *fix*[1] the pictures. Without going any further, it is now evident how the lack of planning and feature delimitation, intrinsic of a proper preproduction phase, were manifested in a protracted and even uncertain schedule.

No one is to blame though. We were simply inexperienced. No one in the team knew precisely how to produce or manage a game project. Likewise, I could not predict how much work my ideas would entail for I had not developed the sort of intuition natural of an experienced designer, or at least I had no reference point on which to base my estimates. So, I fell prey of a naive ambition to produce an unprecedented game, without the solid foundations required for such feat.

4.2.2 Scope

The *first concept* described in the section 3.1 posited the stages of the game merely as if thumbnails in an image gallery. That is, back then I did not contemplate the idea of making a semi-realistic 3D environment in which players could "walk" through. Yet, the transition from one to the other felt natural and it was agreed upon unquestioned. To my dismay, the amount of production work that that simple design decision entailed was immense. There were times in which I felt we were not producing one but two games, in parallel, with the same resources and tied to the same schedule. This impression was not completely unfounded though. The mansion itself could have been the basis for a different type of game based, perhaps, in *point and click* exploration and mystery solving.

[1] *Fixing* is the process by which the unexposed *silver halide* remaining in the photographic paper (or film) is removed. As a result, the paper can be exposed to regular light conditions without affecting the developed image (Wall, 1889, pp. 69-70).

My point being that, with hindsight I could have prevented the major production pitfall in the game and therefore the main reason for its seemingly insurmountable scope.

It is partly pointless to now fancy how the game would have been without the mansion, let alone how the production could have benefited in consequence. But there is a point I want to elucidate based on this notion. The mansion itself originated from a narrative idea and it was perpetuated only for its apparent appeal. Even so, its functional value is relatively scarce. If we put aside all of its aesthetic trappings it only proportionates the interface for the pictures to be accessed and navigated through. To that end, a simpler, yet appealing, interface could have been designed and produced in only a fraction of the time. Naturally, I cannot tell how such change would affect the whole experience of the game. It would not be called Darkroom "Mansion" anymore in the first place. But the gist of the game, the puzzle, would remain and that is what proved to captivate players. Alternatively, the time saved in building a simpler interface to access the puzzles could have been devoted to add more variety to the puzzles themselves, which after developing dozens of pictures in a like manner start to become stale.

Back to reality, the scope, as big as it was, was almost entirely met. Except for a few features that were scrapped from the game or replaced with simpler, more affordable alternatives. For instance, the possibility to zoom into the pictures, or the requisite of collecting the missing film rolls (from which the *negatives* would be extracted) prior to developing the pictures, were both removed from the game. Conversely, the final confrontation with the antagonist of the story was included, almost as planned, but reduced to a bare-bones version. Namely, the amount and complexity of the animated sequences required for the player to meaningfully interact with the monster were drastically reduced. Moreover, I resorted to easy ways to strengthen the challenge and build up tension when players are ought to confront the monster in the final puzzle, by (1) artificially increasing the innate difficulty of the puzzle, and (2) forcing the player to repeat the development stage with the excuse of a tantrum thrown by the monster when facing its imminent defeat. Although these ultimate design decisions led to adequate results, they compromised the aesthetics of the game. Most importantly, they compromised the narrative, which grew thinner and thinner as a result of the optimization strategies meant to hasten the production, especially in its final stages.

4.2.3 Schedule

The game was initially schedule to be released in August 2015, as part of the exhibition "Pimiö - Darkroom" (section 1.1) organized by the museum. However, by the end on July we did not even have a definite design for the puzzle and therefore it was clear that the game would not be ready by the stipulated date.

The release date was then moved to the end of that year, with the exact date depending on when the game would be ready. However, the game was once more far from ready by the estimated deadline. This time, it would be due to the poor condition in which the mansion was; teeming with bugs, laggy and with ailing aesthetics (Figure 4.1). The main reason for this situation was the insurmountable scope due to which we rushed the production of the mansion to an extent that the results were clearly inadequate, practically unusable. In consequence, we agreed to postpone the release until the end of the first quarter of 2016.

Figure 4.1: Screenshot of the darkroom in the game in the condition it was by the end of 2015. The rough and hurried appearance of the environment can be well appreciated from the picture. As the ghostly image of a tormented *Lux* appropriately says, bad things had happened there.

During the first months of 2016 I would try to simply patch the weakest areas in the game to no avail. At that point, a substantial part of the existing code for the mansion had been written by another programmer who took over that part of the game, while I solely focused in the design and production of the puzzles. This code was, however, convoluted and tightly coupled, so making slight changes to it would result in unexpected behaviors and even more bugs. After some time of tweaking that code to no avail, I decided it was wiser to rewrite it from scratch. Naturally, this process would take months several work to be done but once again I assumed that it could be ready by the deadline, which still was about 2 and a half months ahead.

Notwithstanding, by March 2016 I was still far from my goal. Some of the planned refactoring required me to reimplement parts of the mansion which took already a sizable amount of time. Simultaneously, I would still dabble with a “third phase” of the puzzle which was eventually discarded. Anyhow, all the remaining work delayed once more the release until sometime in the summer of 2016.

At that stage of the production the budget had run out and the circumstances compelled me to get a job. As a result, I had considerably less time to devote to the game and thus the production prolonged indefinitely. By the end of 2016 the game was in a solid state but uncompleted, for there were missing features that we agreed should be present in the game, especially after the long wait. During the first half of 2017 features such as the possibility for players to take and develop their own pictures in the game, plus the gameplay sequences by mean of which the players would combat and beat the evil lurking in the mansion. Ultimately, the game was released in July 2017 after being fully developed and thoroughly tested.

In retrospective, it seems almost preposterous to which extent this project was prolonged. There should had been limits imposed to what features, and with which level of detail, would be added to the game. But at the same time, the greatest learnings derived from the development process were the result of the patient, devoted work put into it. Certainly, with more experience we probably would had pulled off a better game in only a fraction of the time. Instead, we strived to accomplish the best we could with the resources and experience we had.

4.2.4 Division of work

From the beginning the development roles were clearly defined and adhered to. However, performing the dual role of *game designer* and *programmer* turned out to be more than what I could sensibly handle. As I explained earlier, the role of game designer is exhaustive in the sense that it oversees that the development of every aspect of the game aligns well with the whole. Usually, the work of the designer is heavy during the preproduction and early production stages of the game but it may subside afterward. Unfortunately, our hazy preproduction and early production phases required a great deal of game design attention too, while I was simultaneously prototyping to validate some of the resulting designs. Moreover, the subsection 4.2.5 will describe as well a variety of technical difficulties experienced during the early production stage. In consequence, I was compelled to temporarily neglect either the dedicated game design or the programming, for as long as I could deliver results in the other.

The inflated scope worsened the situation to such extent that we looked for another programmer to aid the mansion development meanwhile I could concentrate all my efforts in the development of the puzzle. Unfortunately, this backup plan did not prosper for the project budget could not afford another programmer but only for a very limited time. In the end, only through the multiple extensions in the schedule was that we could afford to develop the project almost at full scale and with the resources there were budgeted from the beginning.

4.2.5 Early production

The lack of knowledge in best practices for game development in Unity® hampered the early production process. During the preproduction, I would simply cobble together the prototypes to test the concept. However, I would later find myself unsuccessfully trying to scale that functionality up as a final product, for the results rapidly became unwieldy and thus unreliable. Furthermore, the initial idea for the game morphed significantly through the preproduction stages, therefore some of the logic written for the earliest prototypes would clutter the code base and spread through the ensuing logic.

It would take a few months of learning to get up to full speed on using better practices for development with Unity®. During this process I would particularly benefit from the "pro" development tips by Thorn (2014), especially with regard to even handling, code design patters and the handling of persistent data.

Later on, I would also learn to use more advanced Unity® features such as *light baking* and *shader programming* in general. Through the Unity® documentation and several other online resources I achieved great performance improvements for the game, which by the end of 2015 represented a major concern for the game.

4.2.6 Ultimate goal

There is no conclusive evidence about whether the game succeeded or not in its aim to "engender in children a spontaneous interest" about the darkroom and the chemical-based photographic processing. Big part of the momentum that the game had initially faded along the prolonged schedule. Probably, the game would have received much more attention if released alongside the museum exhibition. Yet, it would have been a much different game than the one I analyzed here. My personal opinion in this regard is that whether we developed an interesting game experience in many regards, the game does not really teach nor motivate kids to dabble into the photographic development. We crafted a fun game that happened to be about photography and translated the photographic development process into ingenious mechanics, but perhaps not much more than that.

5 Conclusions

- *The design of a game concept is to be carried out sensibly and prudently.* It is easy for one to get carried away by the wildest imagination, which sometimes leads to overly ambitious or rather unrealistic ideas. Even though, defying the boundaries is a prerequisite for creativity, and creativity by itself is causal for a good design, as a game designer is important to bear in mind the possible implications of every single design decision one makes. Especially if compelled by deadlines and budgetary constraints.
- *To design a comprehensive concept is key.* I learned the hard way to avoid leaving too many open-ended or unanswered questions during the concept design phase. As game designers it is wise to envision the *what*, *how* and *why* everything in the game being designed will happen. Naturally, it is impossible to think in advance about every single scenario and outcome in a game. Surprises are always to be expected while prototyping and testing design ideas. However, proper preemptive planning will likely save time later in the production process.
- *Start from the core mechanics.* When designing a game is crucial to start from the core gameplay elements. The mechanics in particular should be clearly defined and prototyped before moving into the design of the aesthetics. Some aesthetics will surface naturally in the process of prototyping and playtesting the core mechanics of the game.
- *Prefer paper-prototyping if possible.* Sometimes only a paper-prototype is necessary to test some game mechanics. If that is the case, it will save a considerable amount of time that could be instead invested into the production of the validated mechanics. When to build digital prototypes depends on the nature of the game being designed. There will be cases when developing digital prototypes is the only option. However, paper prototypes are usually a good mechanism to sieve out subpar ideas and see clearly which ought to be prototyped digitally, based on a preliminary assessment of their potential.

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