Anh Le

USER INTERFACE DESIGN PROCESS OF BAROTRAUMA

Investigating the balance between usability and visual aesthetics

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User Interface Design process of Barotrauma
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Suvi Pylvänen

Abstract

This thesis focuses on creating a practical framework on how to balance usability and visual aesthetics in designing the user interface for video games. The productive outcome of this thesis is a graphical user interface for a game called Barotrauma using the framework. This thesis and its productive outcome were commissioned by Fakefish Oy.

After providing a context by discussing Barotrauma's premise, gameplay, target audience, and art direction, the thesis explored the concept of usability, visual aesthetics, and their applications in video games' user interface design using the methods of literature review and case study. The harmonious connection between usability and visual aesthetics in user interface design was the focus of discussion in this thesis.

The practical sections of the thesis concerned the actual production of the user interface of Barotrauma. The production process started with mapping the user's needs in which two personas and two scenarios based on such personas were created. After creating use case diagrams to put into structure the user's needs, the process continued with creating information architecture, wireframing, and prototyping. The prototype created during this stage was then put into testing before developing the user interface's visual presentation.

The visual development process for Barotrauma's user interface started with brainstorming to achieve a general idea of how it should look and feel. Eventually, concept arts were created and the process of creating icons and finalising the graphic elements was also discussed.

The thesis successfully achieved its objectives of a practical framework and creating an actual product based on such framework. As the development continues, the framework is expected to be further applied to adjust and expand the user interface.

Keywords

user interface design, usability design, visual aesthetics, game design

CONTENTS

1 INTRODUCTION

This thesis focuses on how to achieve the balance between visual appeal and functionality in user interface design. This is done through a case study in which the pipeline process of creating the graphical user interface for a video game called Barotrauma along with the artistic and technical decisions made during the production. This thesis explains the methods of how to achieve a functional user interface while maintaining the visual appeal and cohesiveness that does not only enhance players' immersion but also serves as a storytelling and world-building tool. As commented by Donald B. Norman: *It's not enough that we build products that function, that are understandable and usable, we also need to build products that bring joy and excitement, pleasure and fun, and yes, beauty to people's lives* (Norman 2004, 312).

This thesis and its productive outcomes were commissioned by Fakefish Oy, concerning the current game in production, Barotrauma. The goal of this thesis is to create a graphical user interface that is ready to be implemented into the game and a written document that can be used as a guideline for creating user interfaces for other games developed by Fakefish.

The thesis covers its context by discussing Barotrauma's premise, history of development, gameplay summary, target audience, and art direction. After providing a solid contextual foundation, it also investiages theories on usability design and visual aesthetics while discussing the connection between them in user interface design. Eventually, the production process is presented through the chronical order of production phases, from generating personas, scenarios, task analysis, user case diagrams, information architecture, wireframing, and prototyping to surface design.

2 ABOUT FAKEFISH OY

This thesis was commissioned by Fakefish, a game studio based in Turku, Finland. Fakefish was founded in 2014 by a group of students from Turku University of Applied Sciences, with Aku Jauhianen being the CEO. Since its

conception, Fakefish has been actively developing video games on multiple platforms, mostly focusing on doing subcontracts for other studios while financing for its own projects. In 2019, Fakefish has 13 employees with different expertise and professional backgrounds. (Rikkonen 2018.)

Barotrauma is Fakefish's first commercial game. The team for Barotrauma consists of three programmers, two designers, and 4 artists. The author is a part of the art team, working on the game's user interface and this thesis under the supervision of Pekka Saari, creative director of the project. Jämsen and Daniel Asteljoki, who are the game designers of the project, also contribute to the usability design of the game. Rikkonen 2018.)

3 ABOUT BAROTRAUMA

3.1 Summary

Barotrauma is a 2D multiplayer submarine simulation game that is currently developed by FakeFish and Undertow Games. In addition to the conventional simulation features, the game also offers survival horror and resource management elements, with explorable destinations and a level-up system.

Barotrauma's time period takes place in a dystopian future where mankind is building new settlements after the destruction of the Earth on Europa. The player will control a crew member on a submarine carrying various types of missions and unveiling the secret of Europa's former civilisations.

3.2 History of Barotrauma's development

Barotrauma was initially developed solely by Joonas "Regalis" Rikkonen who is now the lead programmer of Fakefish. The first playable build of the game was released for free in 2015 with its source codes being entirely public. Rikkonen (2014) has cited that the inspiration of the game came from several different sources. The resource management system of the game is noted to be inspired by Space Station 13, an open source role-playing multiplayer game released in 2003. The inspiration of the game's marine setting is speculated to be originated

from a game concept originated from the message board 4chan called “Pressure”.

Since its release, Barotrauma has been regularly updated. On August 2018, Fakefish became the co-developer of the game, providing extra human resources for design improvements and a graphical revamp, aiming for a commercial early access release in the first quarter of 2019 (Rikkonen 2018). On March 2019, Deadelic games announced that they are the publisher of the game, handling marketing and public relation matters (Rikkonen 2019).

3.3 Barotrauma’s gameplay

While Barotrauma is originally designed to be a multiplayer game, the game also features a revamped campaign mode of which user interface is the focus of this thesis. This information from this section is extracted from the internally regulated game design document. The game design document is created by the lead game designer of the project, Ezra Jämsen (2018).

Gameplay summary

In Barotrauma, the player takes control of crew members on a submarine to complete a series of missions. These missions are categorised as cargo missions, artefact retrieval missions, monster elimination missions, and mining missions. All the missions require navigating the submarine from an outpost to another. While on missions, the player must also maintain the submarine by handling operational machines and repair them if needed. There are also chances of undesired encounters with alien creatures which require different strategies to either avoid or combat. There are 5 different character classes with different advantages allowing them to perform better at distinctive tasks. The character classes are captain, security officer, medic, mechanic, engineer, and assistant. In Barotrauma, the characters are navigated in a 2D side-scrolling environment. The control of Barotrauma is based on the QWERTY keyboard.

Campaign mode

Campaign mode is an improved feature of the commercial version of Barotrauma. In this mode, the player must complete their missions alone with the assistance of artificial intelligence (AI). While most crew members in the campaign mode are capable of automatically maintaining the submarine, the player can directly control one character at a time and is allowed to switch between the crew members using the Tab key. In addition, the AI-controlled characters can be given tasks via the command menu.

Inventory system

Inventory is an important feature of Barotrauma. Each character is designed to be able to carry up to nine small to mid-sized items at a time, in addition to outfits and accessories that have their own slots. The items in the inventory can be quickly accessed using their assigned number keys.

Crafting systems

In Barotrauma, the player can craft new items from ingredients found during exploration using the fabricator that is often equipped on default submarines. Every craftable item has its own skill level requirements. The same mechanic is applied for medical items that are craftable using the medical fabricator.

Health systems

The health and wellbeing of the player’s crew is a huge aspect of running a successful mission, and there are several ways for a character to break down over the course of a mission, and should all be treated by a medic, using appropriate, specific treatments. Attempting to treat another crew member brings up the medical interface.

Machineries

There are several kinds of machines equipped on the submarine. While some of them are crucial to the ship operation, some are optional and could be unequipped. A functional submarine requires a nuclear reactor, a navigator, pumps, and an oxygen generator. Every machine on the submarine is interactable and has its own distinctive menu to monitor and control upon interacting.

Outposts

Outposts are often the starting points and destinations of the missions. Upon the arrival at an outpost, the player can access the outpost menu which lists available missions. From the outpost menu, the player can also purchase new items and hire new crew members.

Modifications and customisation

Barotrauma is highly open for modifications and customisations with its source code being open. The game also offers in-game editors for submarines, levels, characters, and sprites. Customised contents can be shared and downloaded using the Steam workshop.

3.4 Target audience

Barotrauma's target audience is based on existing information on the free version. Those who have played the free version of Barotrauma are the target audience for the commercial version. However, it is also crucial to point out that the commercial version of the game is designed to be more welcoming towards new players in order to achieve a healthy growth of community for a multiplayer game.

Customer segmentation is taken into consideration when deciding the target audience of Barotrauma. The bases for customer segmentation are geographic, demographic, psychographic, and behavioural. The geographic segmentation base concerns the physical location of most of the audience while the

demographic base reflects variables such as age, sex, and economy status. The psychographic base considers how the target players spend their leisure and the behavioural base identifies the player's behaviour. (Beane & Ennis, 1987.) Understanding these segmentation bases is beneficial not only from the marketing viewpoint but also from the design viewpoint, serving the purpose of creating an appealing and responsive product. Table 1 below indicates the target audience of Barotrauma in four segmentations with data compiled in the marketing and planning document by the community manager Vilma Savolainen of the project (2018).

Table 1. Barotrauma's customer segmentations

GEOGRAPHIC	DEMOGRAPHIC
• Areas with easy access to the Internet. • United States, Russia, Europe	• Age: 18 - 30. •Gender: Male.
PSYCHOGRAPHIC	BEHAVIOURAL
• Experienced, hardcore gamers who seek for games with challenges and complexity. • Being a part of a certain gaming clique. • Enjoy collaborative multiplayer gameplay rather than competitive multiplayer gameplay. • Passionate about customisations and modifications in video games.	• Play video games at least 3 - 4 hours a day. • Active on gaming-based social media platforms such as Twitch, Steam, Discord. • Previously played the free version of Barotrauma and SCP - Containment Breach, another well-known title from the same creator with a similar audience. • Often share their creations and modifications to the community.

Psychographic and behavioural segmentations are more important in the case of Barotrauma as the game is not aiming towards a wide audience but rather a small and dedicated community, seeking to become a cult classic. As the biggest selling point of the game is its complexity and openness for modifications, the game should be targeted at hardcore players who would spend a lot of time tuning the game to their likings. On top of that, the game should also benefit from the foundation built by its free version and previous titles from the creator.

4 ART DIRECTION

The art direction is the process of organising and directing the visual elements of a communication media (Mahon 2010). In the scenario of Barotrauma, the art direction is a compilation of guidelines and visual references that are used by the artists to complement the game's gameplay and setting as well as to achieve the aesthetic cohesiveness.

Barotrauma's art direction is made by Pekka Saari, the creative director of the project. Saari (2018) briefly described the visual of Barotrauma as "dull, depressing, and suffocating." The world of Barotrauma is illustrated as a dystopia with a strong sense of danger and anxiety. Despite the futuristic setting of the game, the aesthetic is aimed for a credible, rusty, and nostalgic feel with the influence of science fiction movies from the 1980s. This is also the reason for the game to avoid a cartoonish direction and rather resort to a semi-realistic rendering style. The general presentation of the game is inspired by cross-section illustrations, with an emphasis on technicality and readability (Figure 1).

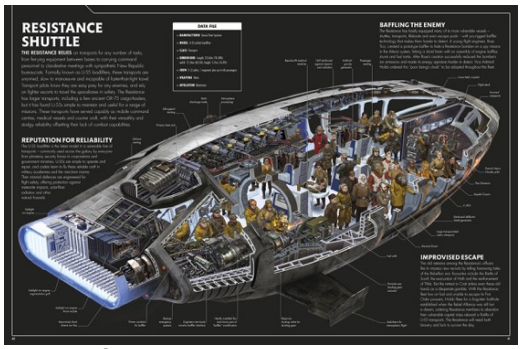

Figure 1. Reference shot for the general presentation of Barotrauma. (Remillard 2015)

A colour scheme with low saturation is used for the game. Most of the objects have a washed-out colour palette to add to the generally depressing tone of the game. Additionally, in order to complement the cross section-like presentation of the game, line arts are used for certain objects and they are advised to be subtle to avoid looking too cartoonish (Saari 2018). The sprite sheet of the navigation panel (Figure 2) is an example of the rendering style of the game.

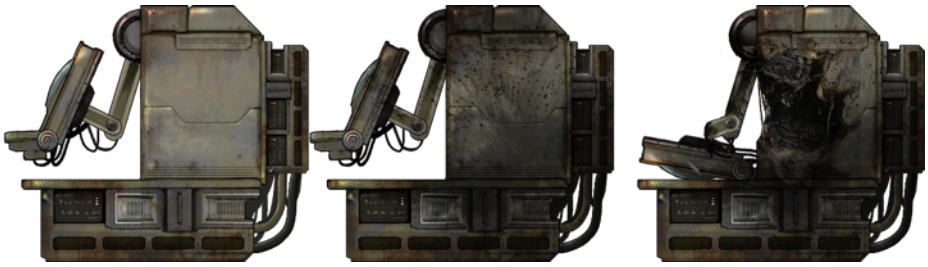

Figure 2. Illustration of the rendering style and the use of colour and line art in Barotrauma.

The stylistic choice of the game's presentation is appropriate for the game's setting. However, with the readability being prioritised, it poses certain challenges as cross-section illustrations have a high level of detail which are not optimal for an interactive scenario when the players have to be in total awareness of the environment. In order to overcome that, several guidelines must be taken into consideration while producing in-game assets. The primary principle is to keep the backgrounds' level of detail lower than the objects in the foreground for the sake of creating an appropriate level of contrast. Additionally, interactable objects should rely on recognisable shapes, resulting in complicated silhouettes being avoided. (Saari 2018.)

Johannes Itten's (1973) theories on colour contrast are also applied to attract the player's attention to interactable items (Figure 3). The colour contrast of light and dark, which is formed by the juxtaposition of light and dark values, and the colour contrast of saturation, which is formed between intense colours and diluted colours, are used to highlight the objects on the background, with them being lighter and more saturated (Itten 1973). Another theory used to create the illusion

of depth that separates the objects from the background is the contrast of colour temperature. The contrast of colour temperature is formed by the juxtaposition of hues considered “warm” or “cool” which suggests nearness and distance (Itten 1973).

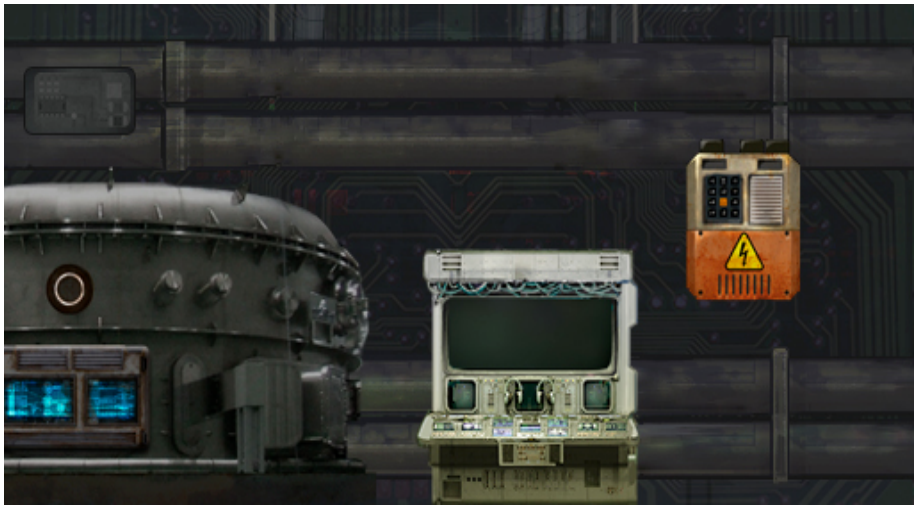

Figure 3. Illustration of practices used to achieve the contrast between interactable objects and the background

Lighting in Barotrauma is limited due to its nature of being a 2D game. Objects and characters in the game have lights rendered on to them to avoid the complexity of creating a dynamic lighting setup. However, colour value, masks, and pseudo specular maps are used to compromise lighting limitations to create a believable and appealing look. (Saari 2018.) It is crucial for the artists to understand the art direction and the design decisions made to overcome the technical limitations in order to proceed further in the production process as it would ensure the artistic unification of the game.

5 AESTHETICS AND USABILITY IN VIDEO GAMES

Michael Nitsche (2008) mentioned that video games in their analytical form consist of five conceptual planes (Figure 4):

- rule-based space is defined by mathematical rules that set physics, sounds, AI, and game-level architecture

- mediated space is the space of the image plane and the use of this image
- fictional space is the space “imagined” by players from their comprehension of the available images
- play space includes the player and the video game hardware
- social plane is the game space of other players affected

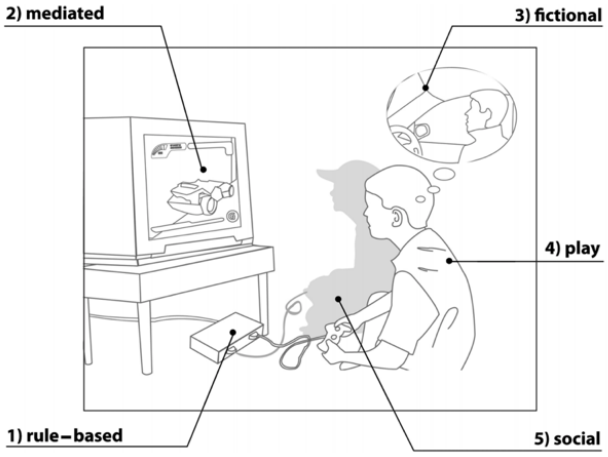

Figure 4. Five analytical planes (Nitsche 2008)

The following part of this chapter discusses the visual presentation aspect of the mediated space, the functionality aspect of the rule-based space, and the connection between these two elements. This section provides theoretical research to achieve the balance between visual appeal and usability in video game.

5.1 Usability in video games

Usability belongs to functionality aspect of video games which refers to the underlying rules determining the player’s actions in the game world and how the game responds to such actions (Nitsche 2008). In the software industry, usability is one of the most appreciated attributes. It concerns the maximised task completion by users by taking into account effectiveness, efficiency and satisfaction (ISO 9241-11: 2018). Nielsen (2012) on the other hand defines usability as follows:

- learnability: how easily the users accomplish basic tasks for the first time of encountering with the design

- efficiency: how quickly the users are able to perform tasks once they are familiar with the design
- memorability: how easily the users can re-establish the proficiency with the design after a long period of not using it
- errors: how many errors the users make, how serious these errors are, and the users can recover from them
- satisfaction: how satisfied the users are after using the design

In video games, usability design is about creating a seamless gaming experience by eliminating unintentional interruptions and challenges. The major difference that separates usability design in video games and general software is that the act of playing video games, in most case, is voluntary. Therefore, the players are more sensitive over annoyance during gameplay. In addition, good usability design also helps a game stand out in a competitive and saturated market. (Laitinen 2005.) In the specific case of Barotrauma, a good usability design will complement the game's selling point of complexity, which will eventually improve the players' experience and contribute to the product's value on the market.

5.2 Visual aesthetics in video games

While the definition of the word "aesthetic" in its Greek etymological root (*aisthesis*) is "perception" or "sensation", it is commonly associated with the theory of art (Marfia & Matteucci 2018). In video games, aesthetics is features that possess the ability to elicit a desirable emotional response in players (Hunicke et al. 2004).

Visual aesthetics in video games encompasses everything from art style to written language (Wilhelmsson et al. 2015), the user interface, animations and more. In short, it concerns visual components of the presentation of video games. The presentation is understood as the expressive elements of video games, mostly covers the audiovisual components of commercial titles. Through the confrontation with it, the player imagines a world from the information provided and decides on actions to affect the game space (Nitsche 2008).

In order to determine the characteristic of a successful visual aesthetics design, the author takes into considerations the ten qualities that make art beautiful presented by Collings in a BBC documentary called What is Beauty (2009):

- nature: reflecting nature figuratively or abstractly.
- simplicity: expressing itself through simple presentations
- unity: being unified through the whole arrangement
- transformation: transforming the world through symbolic images
- surroundings: being shaped by the spectators' experience
- animation: suggesting the continuation in motions
- pattern: being arranged to suggest orders
- surprise: invoking excitements in the spectators
- selection: being able to define what is important
- spontaneity: being interestingly unpredictable

As video games are getting the recognition as an art form (Moriarty 2015), video game developers should take these characteristics into consideration when creating a solid presentation of their games.

5.3 The harmony of usability and visual aesthetics in video games

Although functionality is the prioritised factor in video games (Clauß 2018), the significance of visual appeal in video game is undeniable since gaming is a highly visually dominated culture (Wilhelmsson et al. 2015). In a 2014 survey, 75% of gamers said that visual is the major aspect that determines whether they are likely to purchase a game (Usher 2014). In addition, vision is the human race's most dominating trait, as around 70% of the information we receive is received through our sight (Masuch & Röber 2005).

It is important to remember that balancing usability and visual aesthetics is not about favouring one at the expense of another. In order to understand the connection between usability and visual aesthetics, we can investigate Michael Nistche's theory (2008) on the analytical planes of video games. Nistche (2008) emphasised that while the analytical planes like functionality and presentation of

video games have their own defining qualities and differences, they must all work in combination to provide a fluent gaming experience. According to Nistche (2008), the rule-based space defined by the functional and the architectural structure of video games is the basis for the mediated space, which consists of mainly audiovisual components that provide a form of presentation in order to present the rule-based game universe to the player. In addition, visual appeal does not only serve as a form of information presentation, it is also influential in the success of a usability design.

In addition, the aesthetic-usability effect refers to users' tendency to perceive attractive products as more usable (Moran 2017). Users would be more tolerant of minor usability issues as a result from their positive emotional response toward the visual design. Empirical research found that aesthetics in electronic applications promotes engagements, usability, intrinsic motivation, satisfaction, and an enrichened emotional experience (Amantha et al. 2018).

Despite the positive influence of visual aesthetics in users' perception of usability, the application of aesthetics should always serve an instructional purpose (Mayer & Estrella 2014). The use of aesthetics should not simply be for decoration as there is a high chance that these elements might cause disruptions (Amantha et al. 2018). The next chapter will further explore the concept of the balance between visual aesthetics and usability through the lens of user interface design.

6 APPLICATION OF BALANCING VISUAL AESTHETICS AND USABILITY IN USER INTERFACE DESIGN

User interface (UI) refers to methods and interfaces through which users' actions affect the systems (Quintans 2013). UI design focuses on anticipating the needs of the users and ensuring the accessibility, comprehensibility, and ease of use of the interface.

In video games, UI can include physical elements such as controllers or keyboards and graphical elements such as head-up display (HUD), inventory screen, or map screen (Quintans 2013). The focus of this thesis is on the

graphical user interface (GUI) which refers to a construct of graphically generated elements such as texts, buttons, and images that project the user experience design. In addition, UI in video games differs itself from other fields as it includes the element of fiction (Stonehouse 2014). Fagerholt and Lorentzon (2009) pointed out different types of interfaces depending on their connection to the narrative and game geometry namely non-diegetic, spatial, meta, and diegetic (Figure 5).

Figure 5. Types of user interface elements (adapted from Fagerholt and Lorentzon 2009)

- Diegetic user interface refers to elements existing within the game world fictionally and geometrically to enhance the player's narrative experience. The player's interactions with them can be interpreted as actual actions of their avatar in the game's world.
- Non-diegetic UI elements are elements that are not a part of the game's story and visual environment and can afford to adopt their own visual treatment to ensure successful information provision.
- Meta elements refer to UI elements that do not belong to the geometry of the game world but can still be a part of the narrative. Splatters of blood of

the screen indicating the loss of health is a common example of this type of UI elements.

- Spatial user interface elements are used when the connection of the visual element and the narrative is broken for the provision of more information while the connection to the game's geometry is still maintained to preserve the player's immersion. (Fagerholt & Lorentzon 2009.)

Despite being a visual design process, UI design has a strong connection to usability design as it serves as the visualisation of such concept and structure. Therefore, the process of designing UI for a video game is a good example for the application of balancing visual aesthetics and usability.

In order to further investigate the significance of a balanced user interface in a game's experience design and provide practical references and guidelines for the process of creating the user interface for Barotrauma, examples from commercial video games with polarised user interfaces are taken into consideration.

In 2015, Bethesda Softworks published Fallout 4, a game developed by Bethesda. Since its release, Fallout 4 has received critical acclaims and positive reception from players (Store.steampowered.com 2015), its effective usage of post-apocalyptic setting and 50s aesthetics was also well received (Mozuch 2015). However, the PC version of the game has received much criticism from both critics and players (Younger 2015). Kirk Hamilton (2015) expressed his discontent towards the game's user interface in his review of the game. The pip-boy menu (Figure 6) of the game particularly received a negative response. While the idea of presenting the game's most important menu in a diegetic device would contribute to the game's immersion and aesthetics, the cosmetic elements in this menu totally overwhelmed its actual function (Figure 6).

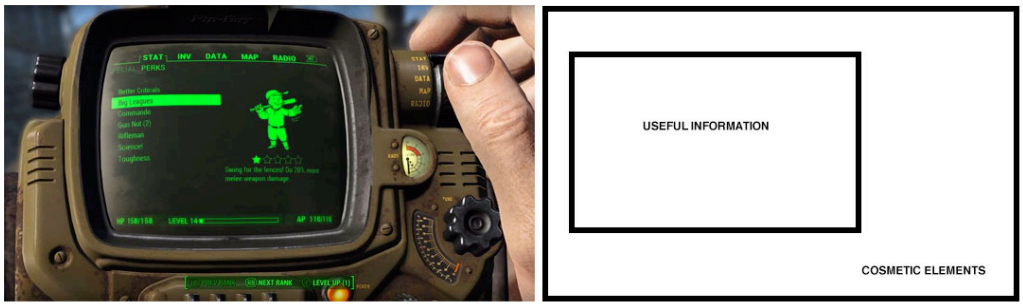

Figure 6. Pip-boy menu, Illustration of the pip-boy menu's use of screen space

The map screen of Fallout 4 (Figure 7) also met criticism for its lack of usability. While Fallout 4's gameplay relies much on exploration, its presentation using just one colour to fit the game's aesthetics was deemed to hinder the player's ability to access the information to explore the game's world.

Figure 7. Fallout 4's map UI (Bethesda Game Studios 2015)

Hamilton (2015) also pointed out inconsistency in how the menu displayed information between tabs (Figure 8). Most noticeably, the HP was shown using numbers in the status tab but a bar in the inventory tab. Allocation and distribution of information are also inconsistent and confusing (Hamilton 2015).

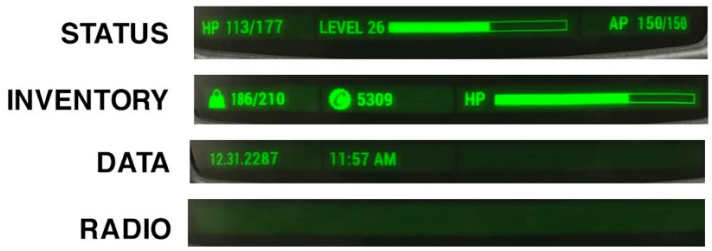

Figure 8. Inconsistent presentation of information in Fallout 4's menu (Bethesda 2015)

Another game with a strongly thematic user interface that are investigated is Persona 5, a 2017 role-playing game developed by P-Studio. Persona 5 has received critical acclaim since its release, thanks to its aesthetic, story, gameplay, and particularly, its user interface. In his analysis of the game's interface, Ridwan Khan (2017) highly regarded how the game blended its aesthetics and theme into the interfaces. While most of the UI elements in the game are non-diegetic, their look and colour palette resembling punk fanzines from the 90s matches well with the game's picaresque theme and urban contemporary setting (Khan 2017). Khan (2017) pointed out that while the game's UI was extravagant and overwhelming, it was highly readable and easy to understand. A good example for this is the dialogue UI (Figure 9) in which all UI elements are clearly indicated using colours, outlines, and character art.

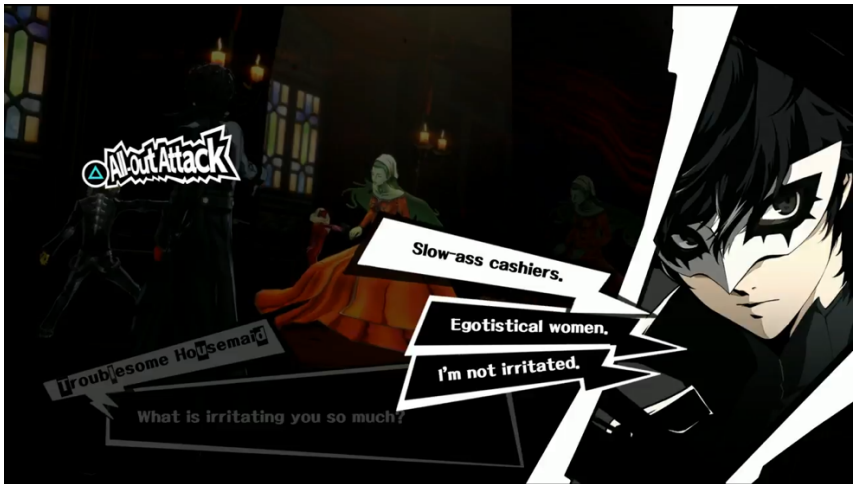

Figure 9. Dialogue UI of Persona 5 (P-Studio)

In addition, while the menus in Persona 5 appears to be overwhelming, they have consistent layouts to facilitate navigation (Figure 10). In Figure 10, the medical

shopping menu and the weapon shopping menu, which are two of the most used interfaces in the game both share a similar layout despite being accessed from two different points. Additionally, each menu has its own thematic graphic elements, such as a green colour and military decorations for the weapon menu and a blue background with science elements for the medical menu, which suggests their functionality, and their placement in the game's narrative.

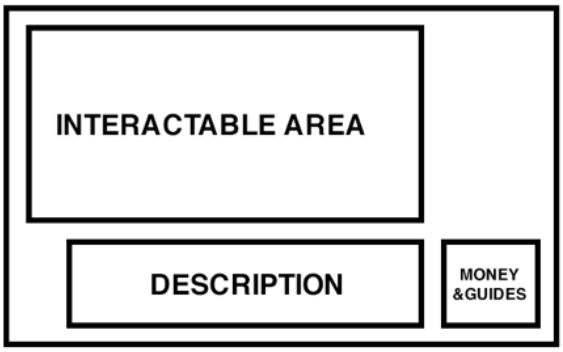

Figure 10. Persona 5's shop menus and the layout shared by the shop menus.

Persona 5 is a good example of how aesthetics and usability are not in a zero-sum conflict. Instead, they can be used in combination to reinforce the game's narrative and themes. Persona 5 is also exemplary in of how to use non-diegetic user interfaces without the expense of players' immersion. Additionally, Fallout 4 also provide valuable insights to approach a thematic user interface despite its flaws. Fallout 4 may also suggest that diegetic user interface requires more effort to balance the usability with the visual aesthetics. In summary, both games have shown that designing a functional, yet appealing user interface takes research and iterations to balance what a player needs at a game interface and what a designer can do to further enhance the gaming experience.

7 CREATION OF THE USER INTERFACE OF THE CAMPAIGN MODE OF BAROTRAUMA

This section of the thesis is about the process of creating the user interface for the campaign mode of Barotrauma by identifying the usability layer of the game and visualising it in an appealing and functional manner. The design process starts with the strategic phase of defining the player's needs. Players' needs are the central point of a user-centric design in user experience design (Gibbons 2016), they define the objectives that the design must fulfil to provide a satisfying gaming experience (Jokinen 2015). A list of functions is formed eventually according to information gained from the previous stage. After that, information architecture is created to facilitate the players' access to the game feature. These data are then used to design the information presentation to facilitate understanding. Ultimately, the final stage of the process is to design the look and feel of the game's user interface. (Raabe 2010.)

7.1 Mapping the user needs

Persona

Persona generation is a method of strategising a design. It concerns creating a user stereotype that defines the name, age, profession, motivation, needs, wishes, values, and other characteristics that may influence the design. Personas are intended to be a practical process of interaction design that will help the designers to focus on the right users (Blomkvist 2006). The concept of personas was originated by Alan Cooper an interaction designer and consultant (see Cooper 2004).

Two personas are created for Barotrauma, representing a player who has experience with the legacy version of Barotrauma and a newcomer. Information used to generate these two personas is from testing applications in which the players have to state basic information about themselves, along with their experiences in general gaming and particularly Barotrauma. The complete list of applications is undisclosable due to its private and confidential nature.

The first persona is Fabien, an experienced player. Fabien is 20 years old. He is based in Spain and currently pursuing a degree in information technology. Fabien has been playing Barotrauma since 2015, hammering hours into it every few months with his friends since v0.2. He has reached the final circle in the campaign and pouring four consecutive afternoons into the Submarine editor. Fabien considered Barotrauma nothing short of a dream game. He is a compulsive completionist, somewhat in the achievement-hunting sense. He wants to see everything a game has to offer and figure out everything he can do with said game.

The second persona is William, a newcomer to Barotrauma. William is a 28-year-old fiber optics technician from Sweden. He has not played Barotrauma before, but he has been checking in on it every now and then on the game's blog. Due to the nature of his job, he is very technically inclined and can easily understand how things work (or why they do not work). He often plays multiplayer games mostly for leisure.

Scenarios

Scenarios are stories consisting of a setting or situation state, a persona, and various objects that the persona can encounter and manipulate. A scenario describes a sequence of actions that ultimately lead to an outcome. Scenario generation is a lightweight method of determining usage possibilities. (Rosson & Carroll 2002.) For Barotrauma, the two personas will be put into two different scenarios according to their previous experience with the game.

The first scenario concerns Fabien, who is the experienced player. Fabien has finished the tutorial level and start a new game. After choosing an easy mission and hiring an extra crew member, Fabien starts his first round. As an experienced player, Fabien enjoys handling the tasks on the submarine by himself. He occasionally switches between the crew members to operate the machines, craft new items, heal injured crew members, and navigate the submarine to the

destination. During the trip, a mud raptor attacked the submarine from the bottom hull and severely damage an engineer. Informed of the attack, Fabien switched to a security officer and used a revolver to kill the monster. After eliminating the alien threat, Fabien switched to a medic and gave treatments to the injured engineer. Fabien then continued to navigate the submarine to the goal. Thanks to his experience, the first round is completed successfully without losing any crewmember.

The second scenario is about William, the newcomer. After completing the tutorial level, William started a new game. He chose an easy mission and purchases some medications. When the round started, William assigned the AI-controlled mechanic to operate the nuclear reactor to power up the submarine. While navigating the submarine to the destination, the submarine crashed into a mountain. William is immediately informed of the hull breaches located at the top of the submarine. He assigned the mechanic to fix the hull. However, the mechanic reported on the communication channel that he is being attacked by a crawler. Fabien rushed to the top area of the submarine to rescue the mechanic. He equipped his captain character a revolver and successfully killed the crawler. Unfortunately, the mechanic was killed during the attack. As the captain was also injured during the fight, William gives himself some medications to stop the bleeding. He then assigned the engineer to operate the nuclear reactor in place of the dead mechanic and successfully navigated the submarine to the destination.

Task analysis & use cases diagram

Task analysis is the process of learning how users perform their tasks to achieve their goals. It assists the designers to identify the information that the users need to successfully interact with the system (Task Analysis n.d.). In the specific case of Barotrauma, a task analysis is a breakdown list of the smallest actions that can be created as their own task of a given scenario.

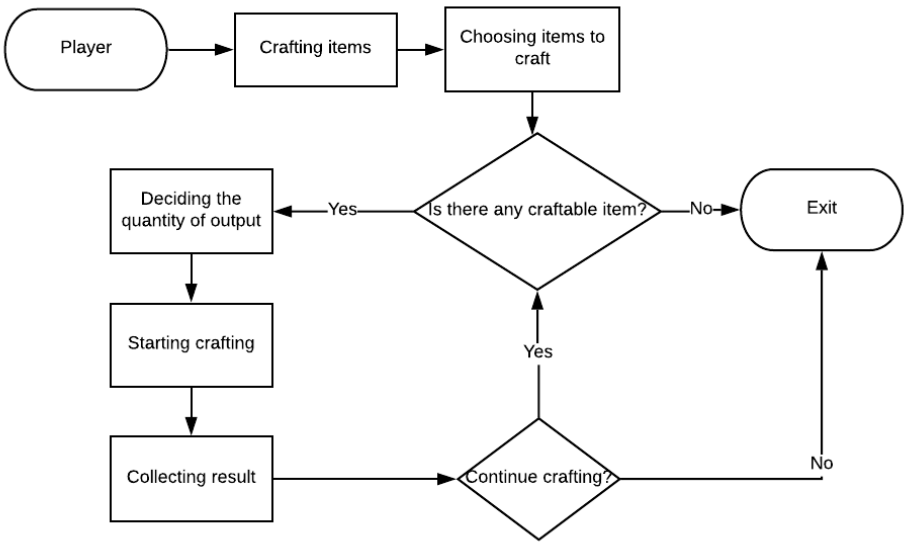

Figure 11. Use cases diagram of the crafting system

A use cases diagram is a visualisation of task analysis. After breaking down the persona's actions in the scenario, the tasks were compiled the tasks using flowcharts (Appendix 1). These flowcharts are used to form an information architecture to determine the information that needs to be presented to the players. For example, the UCD for the crafting system (Figure 11) illustrates what a player would do when using the crafting interface.

7.2 From information to a prototype

After analysing the users' needs, the next step is to structure and design the layout of information that is going to be presented to them. Eventually, an interactable prototype is made accordingly to the design for the players to test the interface's functionality.

Information architecture

Using the flowcharts that indicate the players' interaction with the system, information architecture is formed. Information architecture is the structural design of information that is presented to the users to help them achieve their goals (Cardello 2014). The author created the information architecture in a form

that is similar to sitemaps used in web designs and other information systems (Appendix 2), which illustrating the grouping of related content and the hierarchy of information (Ritter & Winterbottom 2017). Figure 12 is an example of the information architecture for the crafting system created to felicitate the tasks that the player would perform to craft items using the fabricator interface.

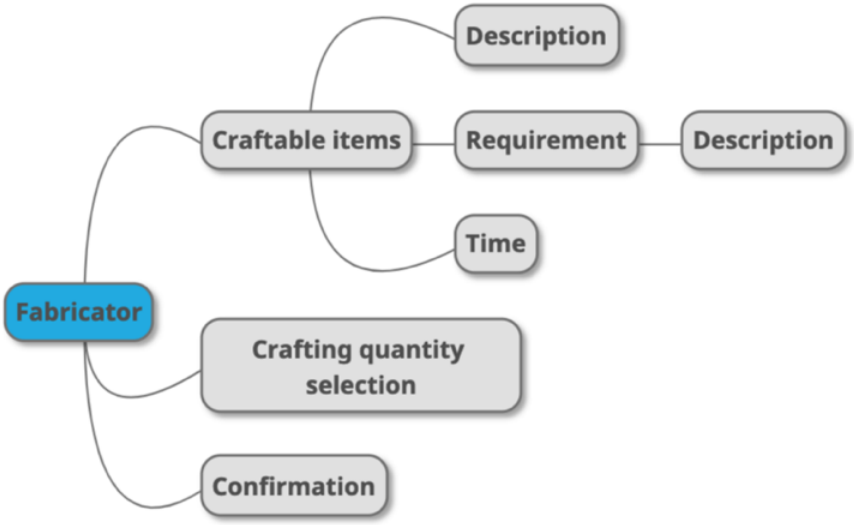

Figure 12. Information architecture of the fabricator interface

Wireframing

Wireframing is the technique of visualising a screen's interface focusing on space allocation and prioritisation of content, functionalities, and intended behaviours. A wireframe is used in the development phase to present to the team and client a unified vision of the UI which helps to identify usability problems in the early stage of production. Using wireframes to present a UI idea allow designers to easily try out different layout options. (Wireframing n.d.) During the wireframing stage, the designer took suggestions for characteristics of wireframes which are quickness, inexpensiveness, viability, clarity, simplicity, refinement, flexibility, and ambiguousness (Lepore 2010) into consideration. The wireframes for Barotrauma were created by the game designer Jämsen after analysing the information architecture and the game design document. Wireframes and usability notes can be found in Appendix 3. Figure 13 is the wireframe of the fabricator interface, it

shows the allocation of information required for the player to use the crafting system. As wireframes are recommended to be quick to made and change, the wireframes of Barotrauma are made using simple blocks and notes to allow quick demonstration and adjustments.

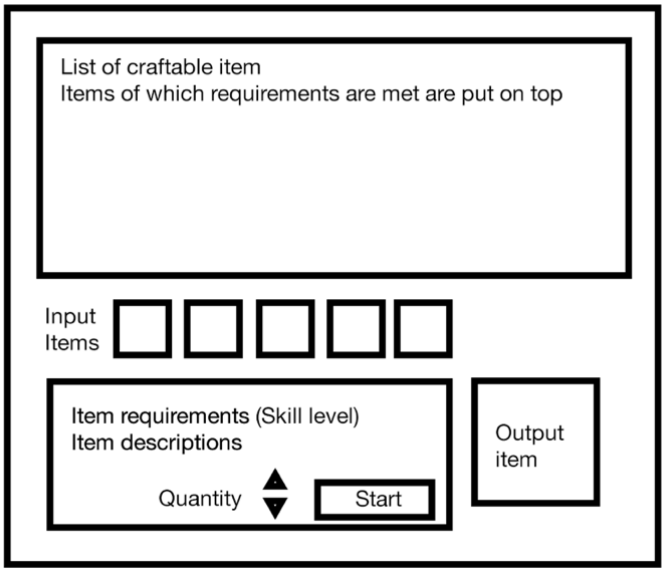

Figure 13. Wireframe of the fabricator interface (Jämsen 2018)

Prototyping

After clearly identifying the requirements and constraints through wireframes, prototyping is the next stage. A prototype is a draft version of a product that illustrates the intention behind a feature or the overall design concept to users in a functional form, be it a paper prototype or an actual application (Harty et al. 2016). A prototype is suggested being quick, inexpensive, clear, elaborated, refined, flexible, and validated (Lepore 2010).

The wireframes designed in the previous phase were delivered to the programmers to implement into the game as a functional prototype. While the prototype uses mostly default graphical assets, the functions are fleshed out enough and ready for testing. After the testing phase, most of the adjustments are going to be performed directly to the prototype. In addition, during the surface design phase, new graphical assets are going to replace the default assets.

7.3 User testing

User testing is a fundamental usability method that provide information about how users interact with the systems to identify design errors and aspects that need improvements (Nielsen 1993). As the game is in the alpha-testing phase, the usability testing session is conducted separately from the general play testing sessions by the commissioner which are to find technical bugs and design flaws. The author conducts the usability test with the authorisation from the commissioner. The result of this testing session is analysed by the author and the game's designers to adjust the interface design of the game before advancing to the surface design phase.

In order to test the design, the prototype user interface mentioned in the previous chapter was included in the alpha build of the game that is shipped to qualified players who applied for the testing. Six players were chosen specifically for the usability test, three of them are experienced players while the other three have less experience with the game. They are asked to play one round of the game. The players will play with a premade submarine that is design specifically for the test. While they are free to play the game as they like, each round has a set of objectives that they must complete including:

- Hire a mechanic.
- Buy an oxygen tank.
- Pick a cargo mission.
- Assign a mechanic to turn on the nuclear reactor.
- Deconstruct a revolver and use newly acquired material to craft another revolver.
- Go to the specific room to confront a crawler.
- Give yourself treatment.
- Navigate to the goal.

After the play testing session, the players are asked to fill out a questionnaire concerning the user interfaces that they interacted with during the session (Appendix 4). The questionnaire is based on Fred D. Davis' (1989) theories on users' perceived ease of use.

Test result

The test result has pointed out that most players were able to complete the task list, only two of them failed the last tasks. However, they stated that the failure was due to their own carelessness and inexperience in controlling the submarine. While most user interfaces received satisfactory results, the nuclear reactor interface was perceived by one of the inexperienced players and to be difficult to understand as first. The player pointed out that they were not aware that the nuclear reactor required fuel rods to operate. Four players also pointed out that while the menus were functional, they were not exciting to interact with as the graphics were mostly placeholders. After analysing the test result, the game designer made a few changes accordingly. The next stage is to start developing the visual for the user interface.

7.4 Surface design

This section of the chapter concerns the visual design of Barotrauma's user interface. Surface design determines the look and feel of the interface, using layout, icons, typography, and colours (Elgabry 2016). The process of designing the visual layer of the interface starts with brainstorming to establish the general feel of the interface. Concept arts are made eventually to visualise the interface with more concrete aesthetics. Ultimately, the finalised assets are created and delivered to the programming department for implementation. In addition to being an aesthetic design process, the visual development phase of the interface relies on information from earlier phases to guarantee that the visual elements can support the functionality of the game and deliver an immersive gaming experience.

Brainstorming

Brainstorming is a problem-solving method that was popularised by Alex Osborn (1953). The method is a group activity where individuals contribute their ideas and concepts with an emphasis on quantity to solve a problem (Osborn 1953).

During brainstorming sessions for the visual design of Barotrauma's interface, the author and the art director have generated several ideas. The end result of the sessions is mood-boards that illustrate the idea of combining science fictional interfaces in movies from the 80s with rustic Soviet machineries (Appendix 5). The combination is expected to fit the game's art direction while still offering an exciting twist to encourage interactions from the players. The author eventually processes the mood-boards and starts developing concept arts.

Concept art

Concept art is the visualisation of ideas with the purpose of demonstration (Ballesteros 2017). In this phase, the author translates the ideas generated during brainstorming sessions into visual mock-ups that illustrate the look of the user interface in the directed aesthetics.

After analysing the mood-boards and discussing with the art director, the author decided to make most of the interfaces of the machines diegetic. Despite the previous case studies about diegetic interface requiring more effort to balance between usability and visual aesthetic, its ability to offer players the immersion of using actual machines could be considered a huge advantage. To further explore the direction of using diegetic elements, the interfaces were intended to look like control panels with physical buttons and lights combining with certain elements made to be inside displays such as screens or holographic projections (Appendix 6).

As interactable elements of the interfaces were suggested looking like they are physical parts of the control panels, they were designed to resemble buttons and lights that matched the aesthetic of Soviet machines (Figure 14). Figure 14 also illustrates how regular elements of user interfaces like tick boxes, radio buttons, and toggles were purposefully designed to retain their classic appearances with a few tweaks to suggest diegetic materials while still being able to serve their functional purposes.

Figure 14. Physical buttons and commonly used user interface elements

Once the look of individual elements was decided, the author assembled them into different interfaces strictly according to the wireframes to preserve the functionality (Appendix 7). As every interface serves a distinctive objective, a few thematic details were added to give the interfaces interesting flair such as a blue print background for the fabricator's interface (Figure 15) or wires and cables to suggest the flexible nature of the navigator's interface (Appendix 8).

Figure 15. Concept art of the fabricator UI

During this phase, a few design proposals were declined in favour of usability. One of the declined proposals was to replacing status text in the reactor interface to save more space on screen which was deemed to be potentially confusing as the status system of the reactor interface requires a more in-depth form of communication. Another proposal about using more cosmetic animation in the interface was eliminated due to unnecessary workload and potential performance issues that might interrupt the experience. On the other hand, several of them were applied to improve usability such as blinking animations to draw player's

attention to important information and adaptive graphics that are easily customised by players.

Icon design

Icon design is a significant part during the visual design process of the user interface of Barotrauma. In the in-game HUD, many icons are used in place of texts and description to either save screen space or be quickly recognised. The icons in Barotrauma represent the locations of the game's map, the commands in the command menu, and the afflictions of the player. In order to ensure effective communication, several representation strategies were used during the process of design the icons for the game.

One of the strategies used during the design process is representation through visual similarity which refers to the act of reproducing the visual characteristics of the referent (Nakamura & Zeng-Treitler 2012). This strategy limits to only physical objects with an easily identifiable shape (Nakamura & Zeng-Treitler 2012). Figure 16 illustrates examples of icons using this strategy.

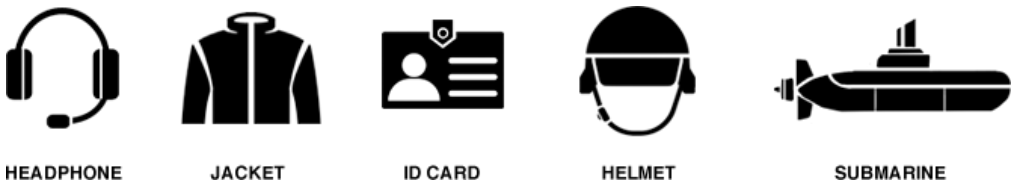

Figure 16. Examples of icons designed using visual similarity

Another strategy used during the design process is representation through arbitrary convention which refers to using the connection established by reinforcement to represent a concept (Nakamura & Zeng-Treitler 2012). The icons in Figure 17 were designed using this strategy that could be categorised into three subtypes: abstract convention, concrete convention (Nakamura & Zeng-Treitler 2012). Transposed convention is also a subtype of this strategy, but it was not applied during the design process

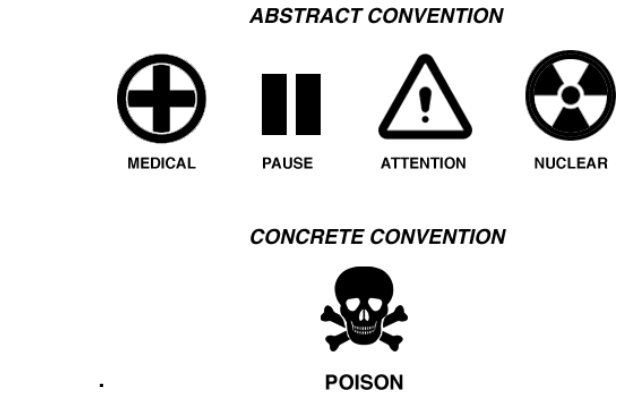

Figure 17. Examples of icons designed using arbitrary convention strategy

Another strategy used to design the icons for the game is representation through semantic association which refers to the mediated relation between icons and referents (Nakamura & Zeng-Treitler 2012). The relation is categorised into comparison or contrast, exemplification, semantic narrowing, physical decomposition, body language, metaphor, and contiguity (Nakamura & Zeng-Treitler 2012). Figure 18 exhibits an example of the icons design using different categories of this strategy to successfully communicate with players. It is also noted that some of the connections were established within the game's world, for example the icons for the habitation outpost and colony were design using the actual design of in-game residential constructions to represent the locations.

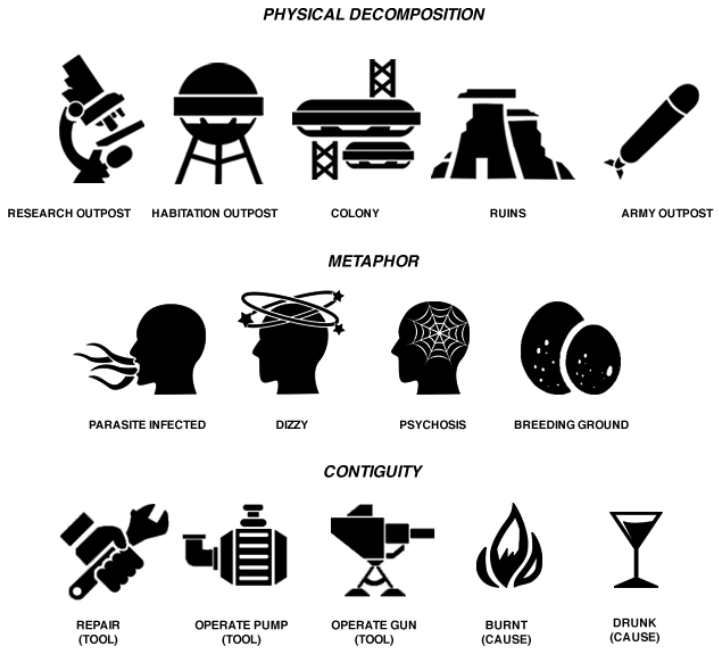

Figure 18. Examples of icons designed using semantic association strategy

As representation strategies are not mutually exclusive (Nakamura & Zeng-Treitler 2012), combinations of the representation strategies were also used to design more complicated and abstract concepts. Figure 19 presents examples of icons design using multiple representation strategies. Combinations of representation strategies are expected to be the most effective in terms of usability design (Nakamura & Zeng-Treitler 2012).

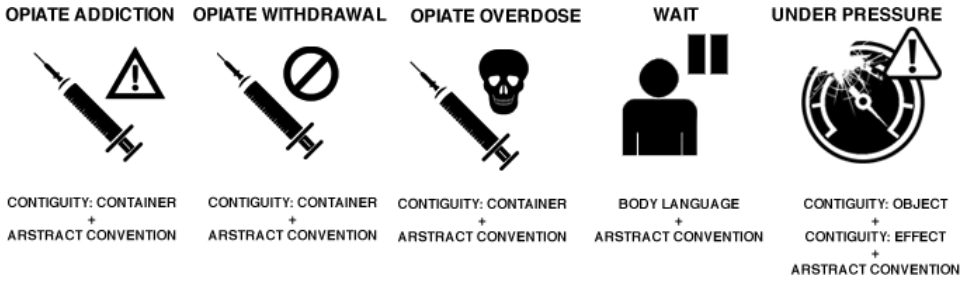

Figure 19. Examples of icons designed using combinations of representation strategies.

The icons in Barotrauma were designed to be simple and versatile so that they can be used in different parts of the interface. Due to their significance as a communication tool and a part of the visual system, theories on iconic presentations were applied to ensure their functionality and visual cohesiveness. While the icons were only evaluated in-house before implementation, more in-depth user testing sessions on the readability of the icons are expected during early access.

Finalisation & implementation

The works of concept art were approved by the art director to advance to the production of actual assets. During this phase, graphical elements from the concept arts were taken apart to refine and compile into atlases that fit technical requirements. Figure 20 illustrates the navigator interface after refinement that is ready to be taken apart into smaller pieces for implementation.

Figure 20. Navigator UI after refinement

In Barotrauma, in order to optimise the game's performance and lower loading time by avoiding loading too many image files at once, most of the graphical assets are compiled into atlases from which the programmers will slice into rectangular pieces using the engine and assign each piece to a specific object. In addition, the atlases are recommended to be squares in power of two. After refining the interface elements, the author compiled them into five atlases using Adobe Photoshop, namely two atlases for icons, one atlas for dialogue backgrounds, one atlas for interactable elements, and one atlas for cosmetic elements. Each atlas has its own format and guidelines for a systematic implementation.

The icons were categorised into location icons and in-game icons. The location icons were put into a 1024x1024 atlas in which every icon was required to align perfectly in a 256 x 256 square. Photoshop's features of guides and snapping were used to ensure the alignment (Appendix 9). Similarly, in-game icons were compiled to a 1024x1024 atlas with the icons fitting into 128 x 128 squares using the same technique (Figure 20). Empty spaces on the atlases were intended for eventual additions of content (Appendix 10). The atlases for interactable objects and cosmetic elements have less strict alignment rules with the primary principle is to avoid overlapping placement of the graphics (Appendix 11). Ultimately, the atlas for dialogue backgrounds is a 1024 x 1024 image file with each background

fits into a 512 x 512 square (Appendix 12). Each background was also sliced using the 9-slicing technique to be reuse in different size (Docs.unity3d.com. n.d.).

The final atlases were delivered to the developers for implementation. The new user interface will be included in Barotrauma's early access build and remain open for adjustments and additions until the game exits early access.

8 CONCLUSION

This thesis provided a practical framework to achieve the harmonious connection of usability and aesthetic in video game development. It is crucial to note that functionality and visual appeal in video games do not cancel each other, but instead work in combination to serve not only as an essential gateway to interact with the game world but also an effective tool to reinforce a game's story and theme.

Designing a user interface for a video game is a process that requires research, strategies, and iterations. Defining users' needs is regarded as an effective method of developing a concrete foundation for eventual strategic decisions. By backing design decisions with theories and throughout user research, designers can guarantee the functionality and the appeal of a user interface.

The creation of the user interface of Barotrauma has successfully put the framework of this thesis into practice by mapping the users' needs, structurally designing the presentation of information, and making artistic decisions according to research and achieved data. While the decision of using diegetic user interfaces has improved the game's visual appeal, it also posed a few challenges in maintaining the usability that required iterations and compromises to overcome. During the design process, a few visual presentation ideas were eliminated in favour of usability while several of them were applied to improve.

The theories defining visual aesthetics were also applied to guarantee appeal of the interface. The decision of using diegetic elements required the interface to

reflect its setting of a harsh world. The graphics were also designed to be unified and suggesting of a hierarchy. Cosmetic elements were also included to provoke players' excitement and differentiate the interfaces. The user interface was also designed to be simple and straightforward. In addition, information was successfully interpreted through iconic presentations. The application of theories on visual aesthetics did not only affect the game's visual appeal, but it also enhanced the interface's usability by visually structuring information and presenting them in a more comprehensive medium.

While the thesis has met its productive objectives, there are still room for improvement as the game is entering early access which allows more user data to be investigated. Further user testing sessions on icons' readability and how players perceive the graphical changes are expected during the early access. By continuing to apply the framework with a consideration towards the players, it is anticipated that the user interface will greatly contribute to the game's overall experience and immersion.

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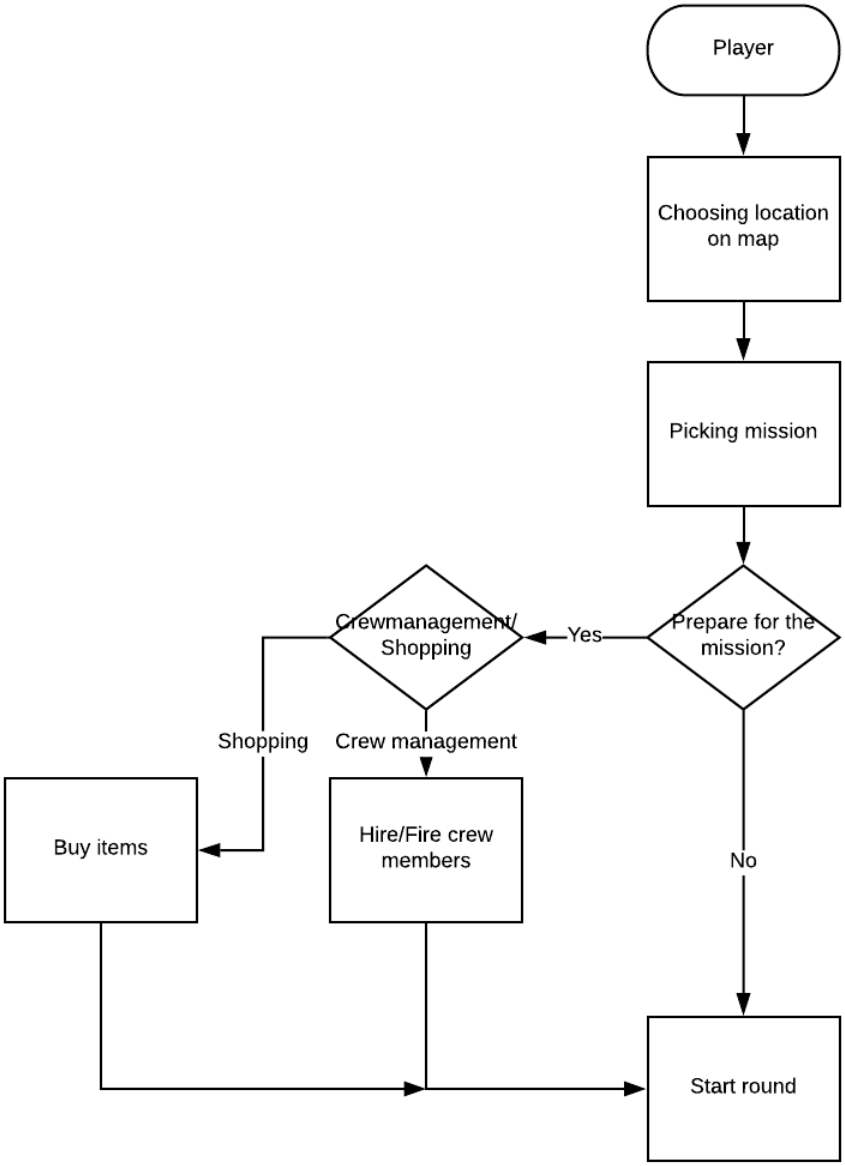
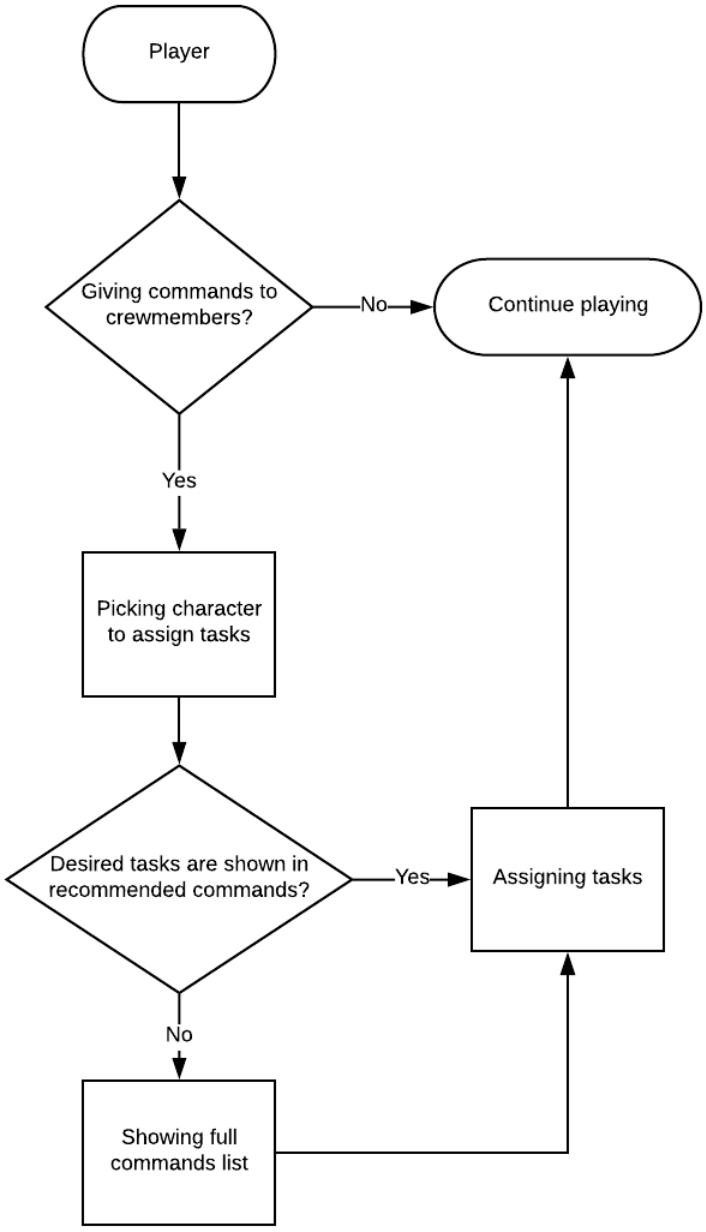
LIST OF FIGURES

Appendix 1/1

USE CASE DIAGRAMS

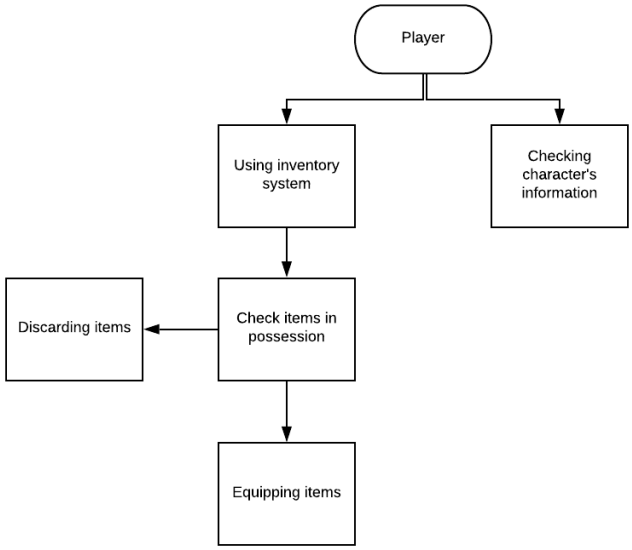


Mission screen UCD

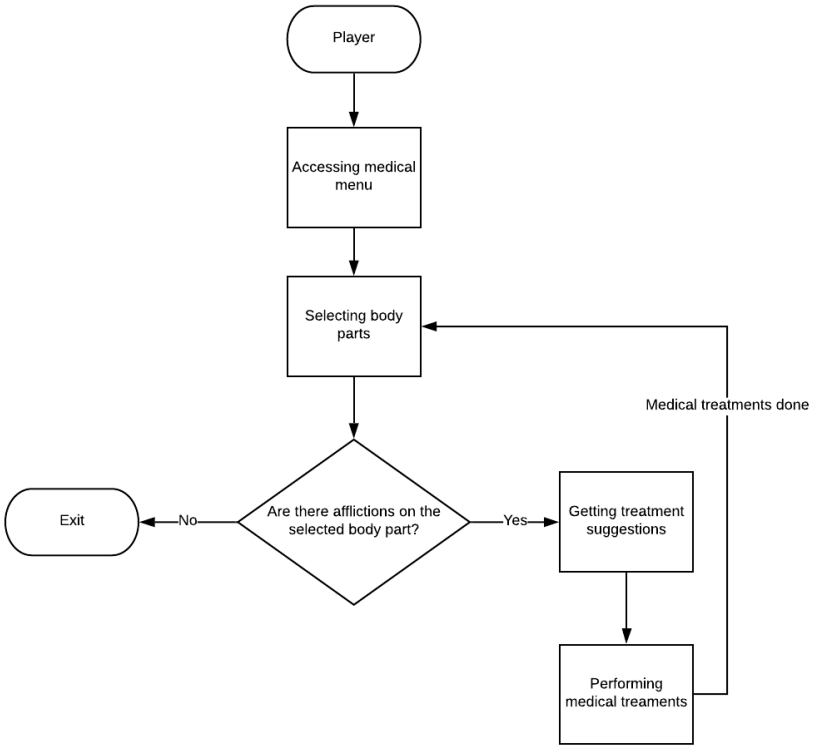


Command menu UCD

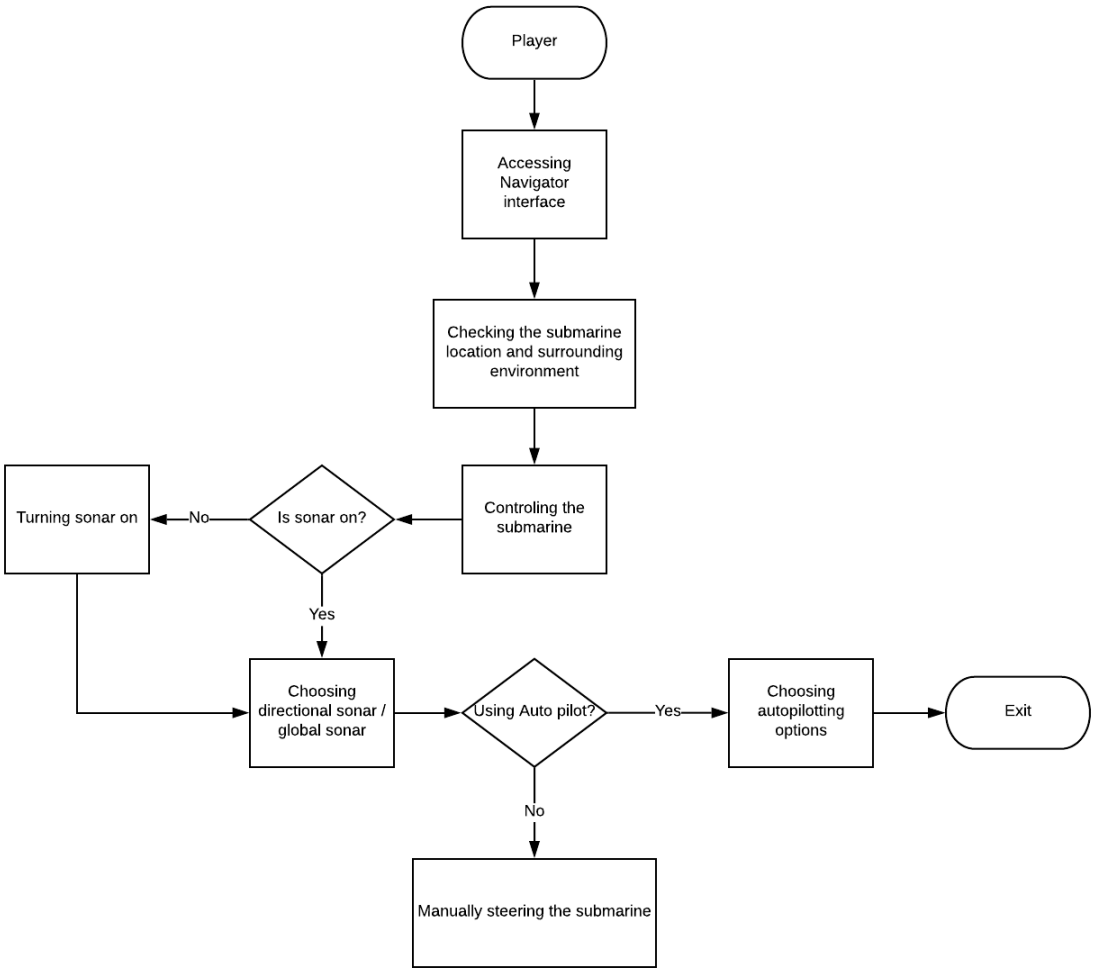
Appendix 1/3



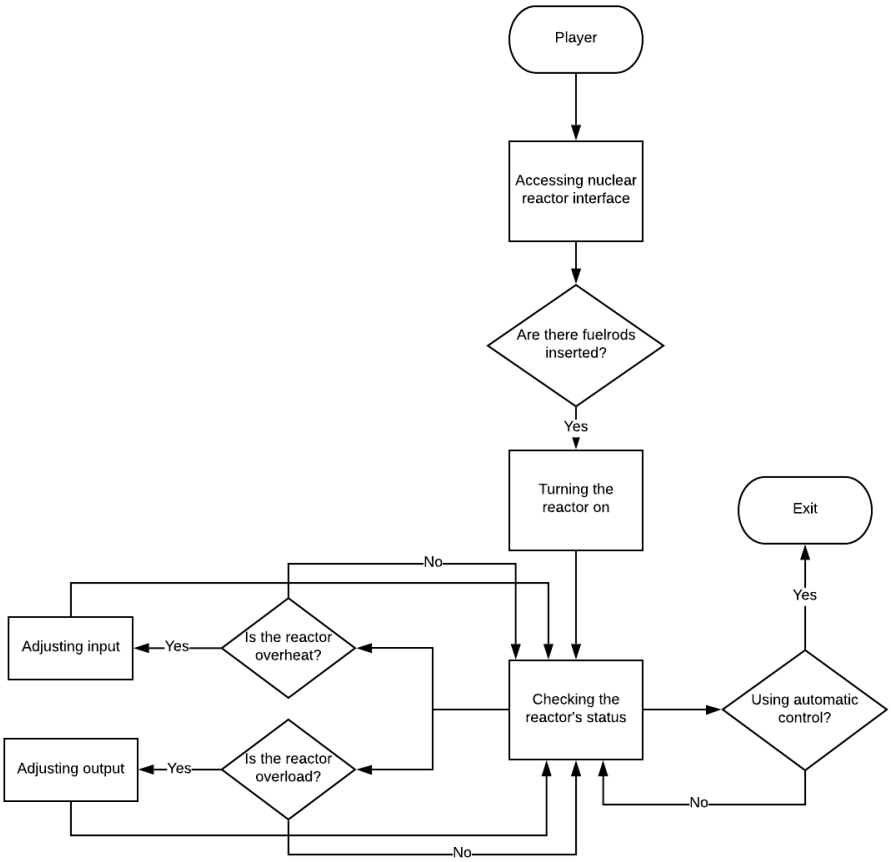
Inventory system UCD



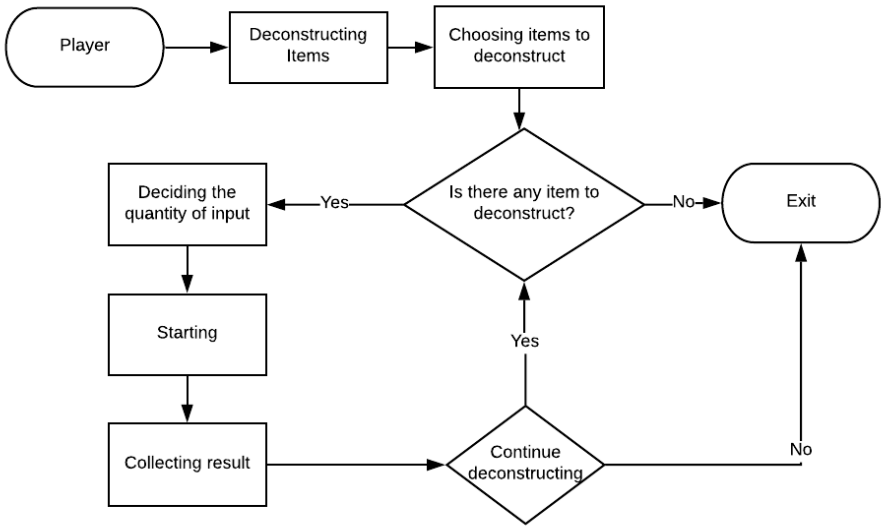
Medical Menu UCD



Navigator interface UCD



Nuclear reactor interface UCD

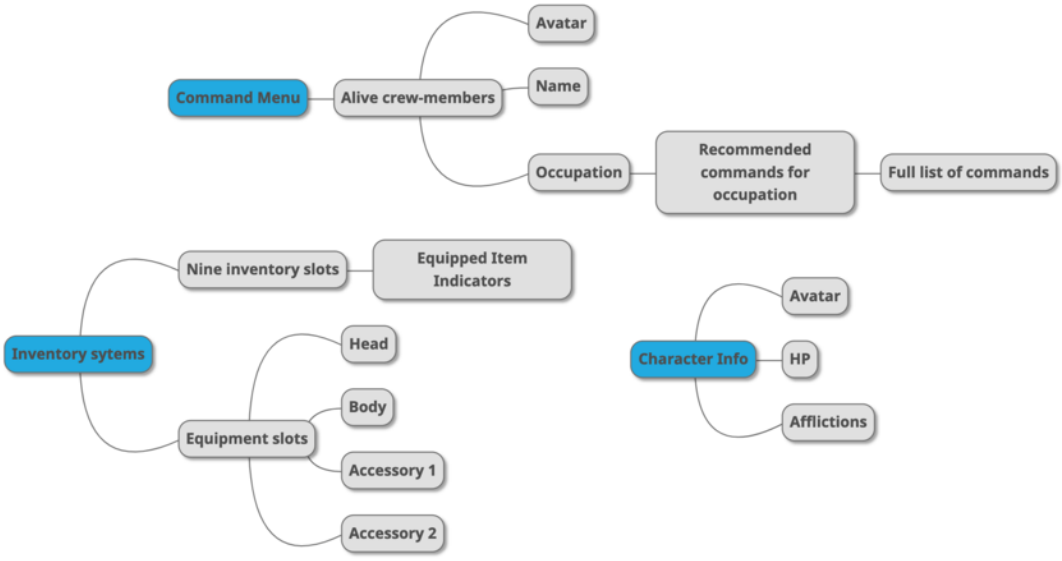


Deconstruction interface UCD

Appendix 2/1

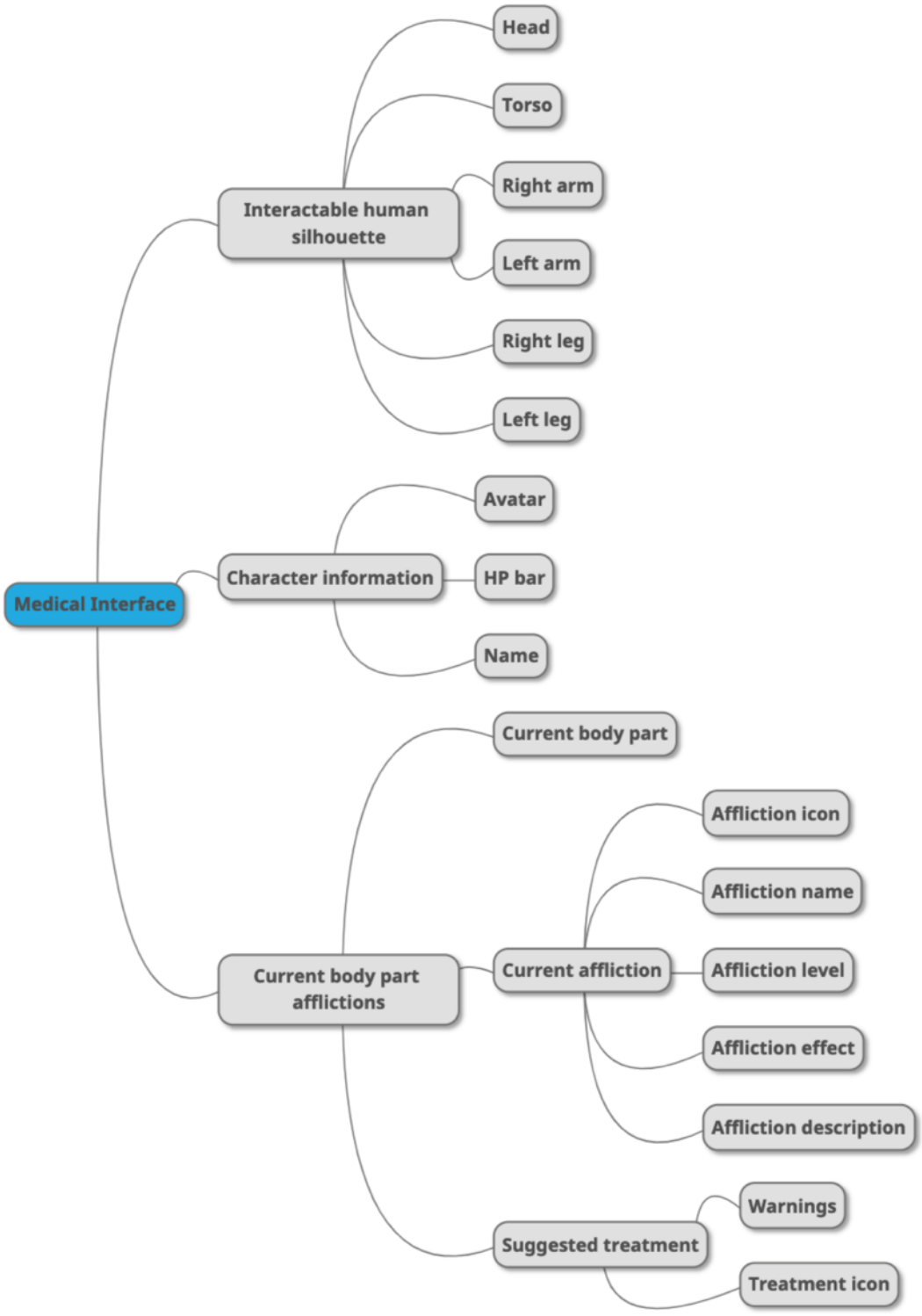
INFORMATION ARCHITECTURE

Mission menu information architecture



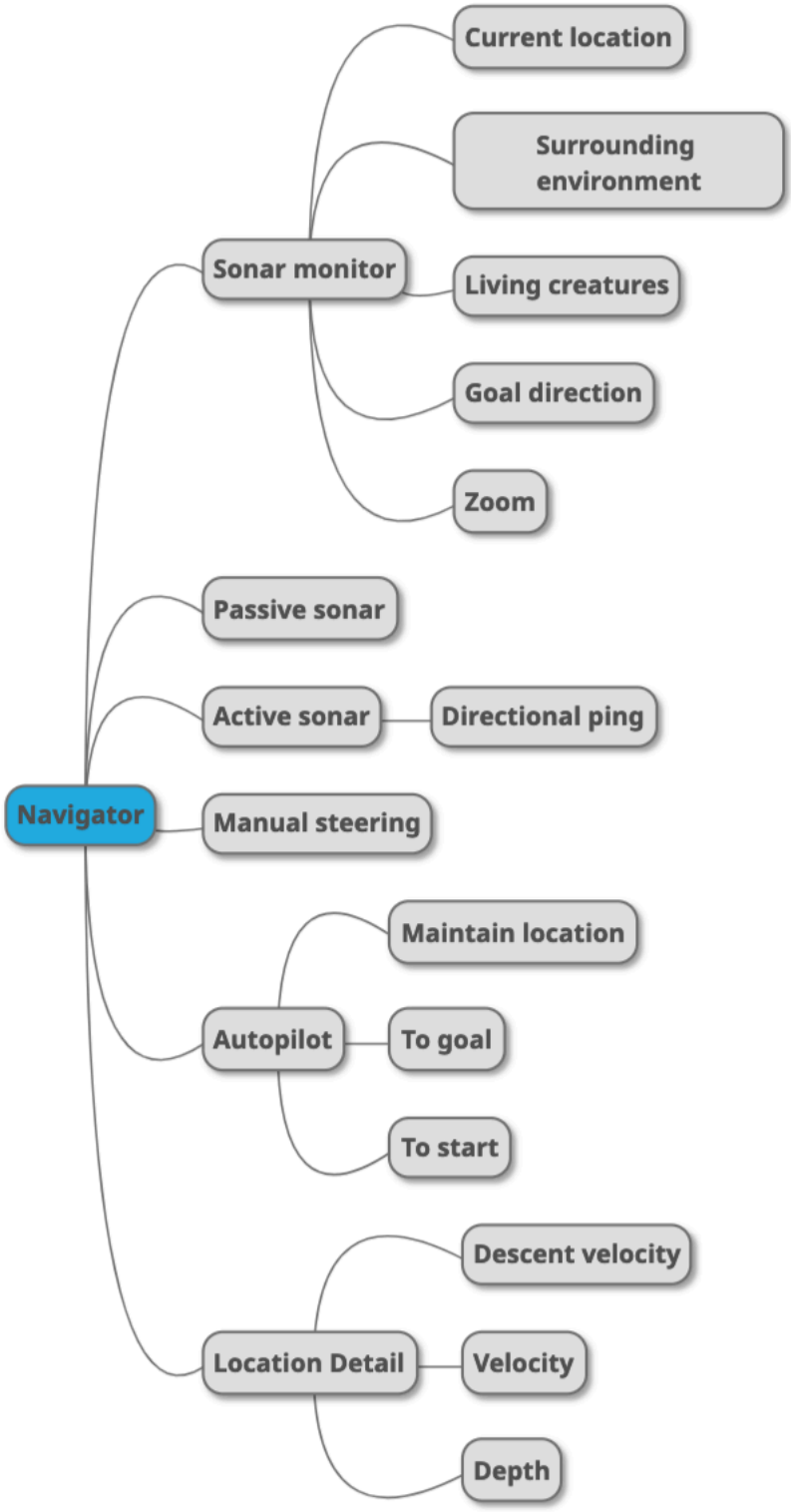
In-game UI information architecture

Appendix 2/2

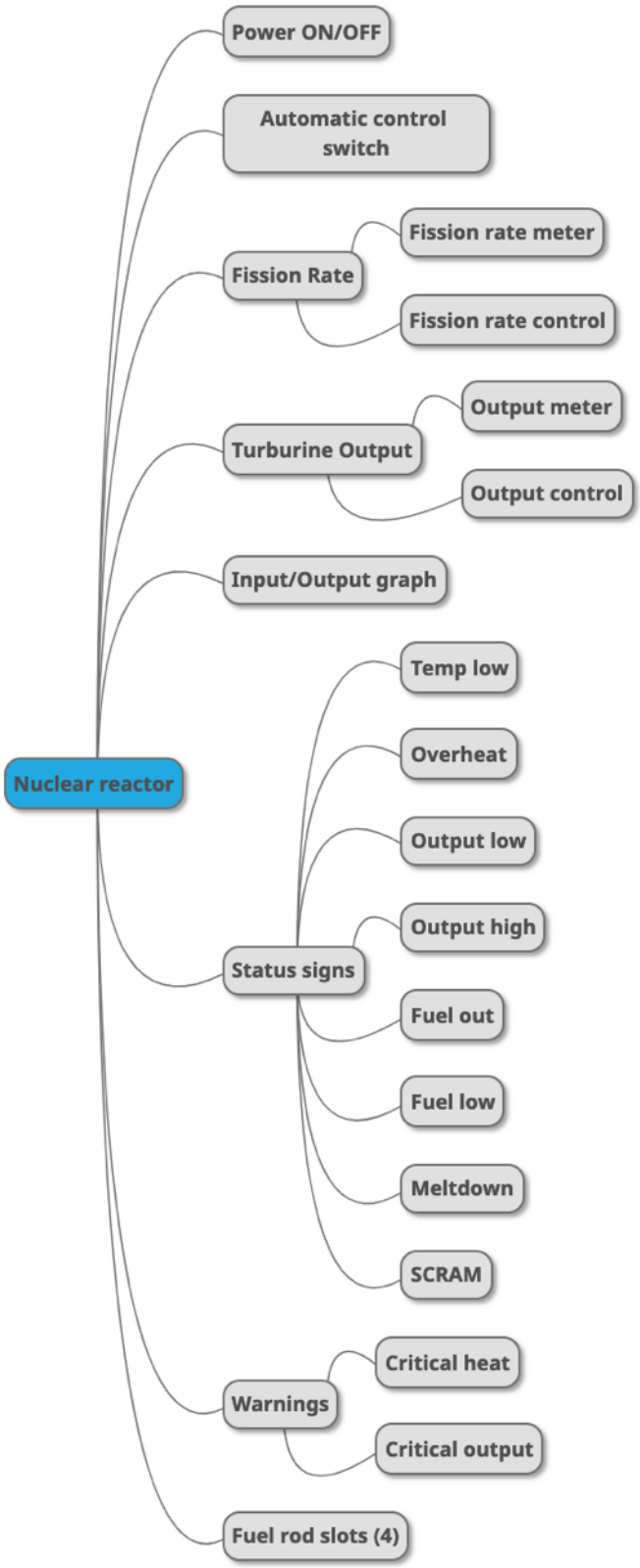


Medical Interface information architecture

Appendix 2/3

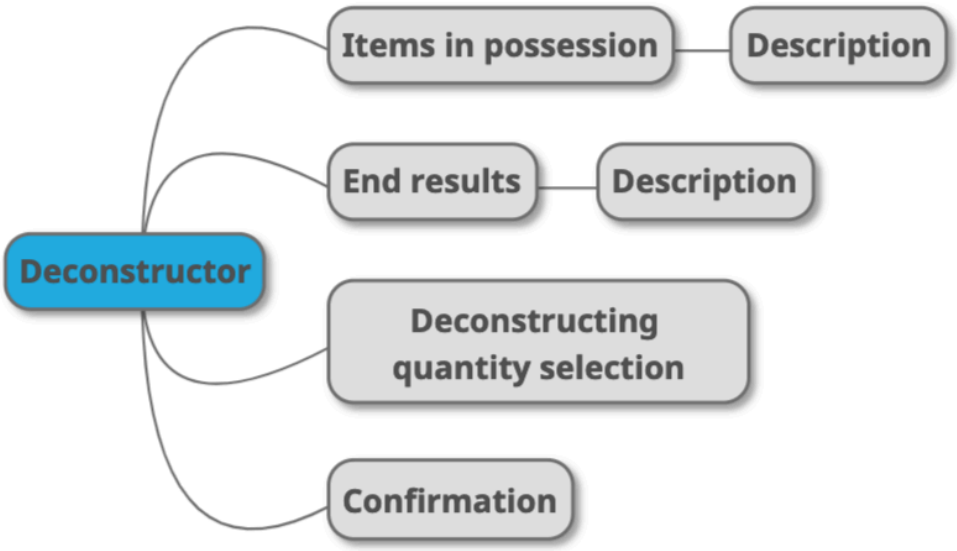


Navigator interface information architecture



Nuclear reactor interface information architecture

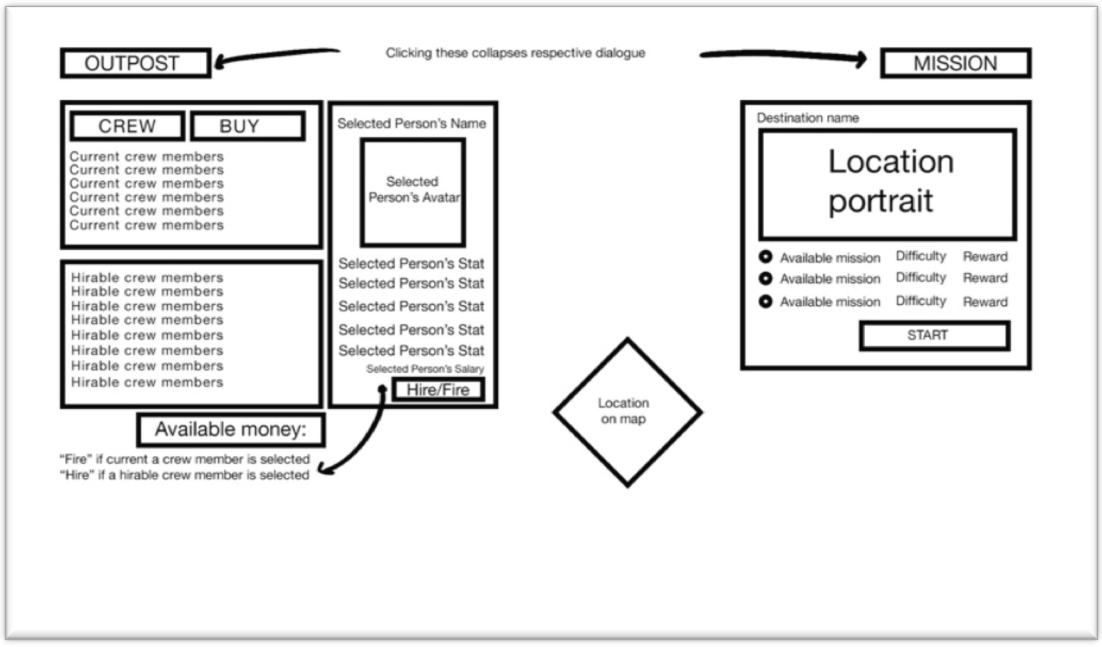
Fabricator interface information architecture

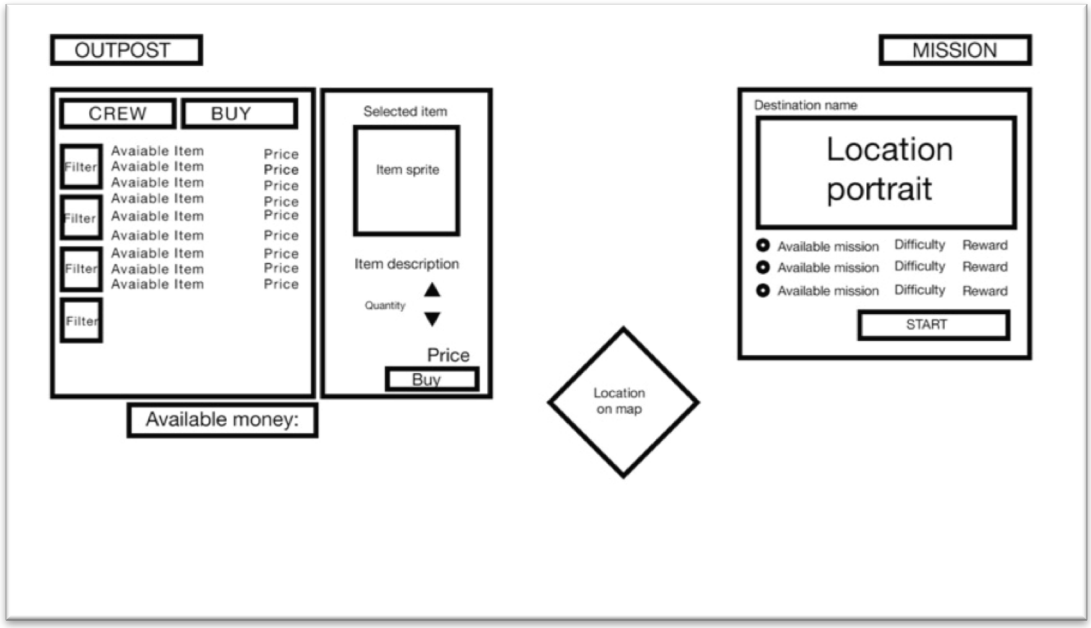


Deconstructor interface information architecture

Appendix 3/1

WIREFRAMES



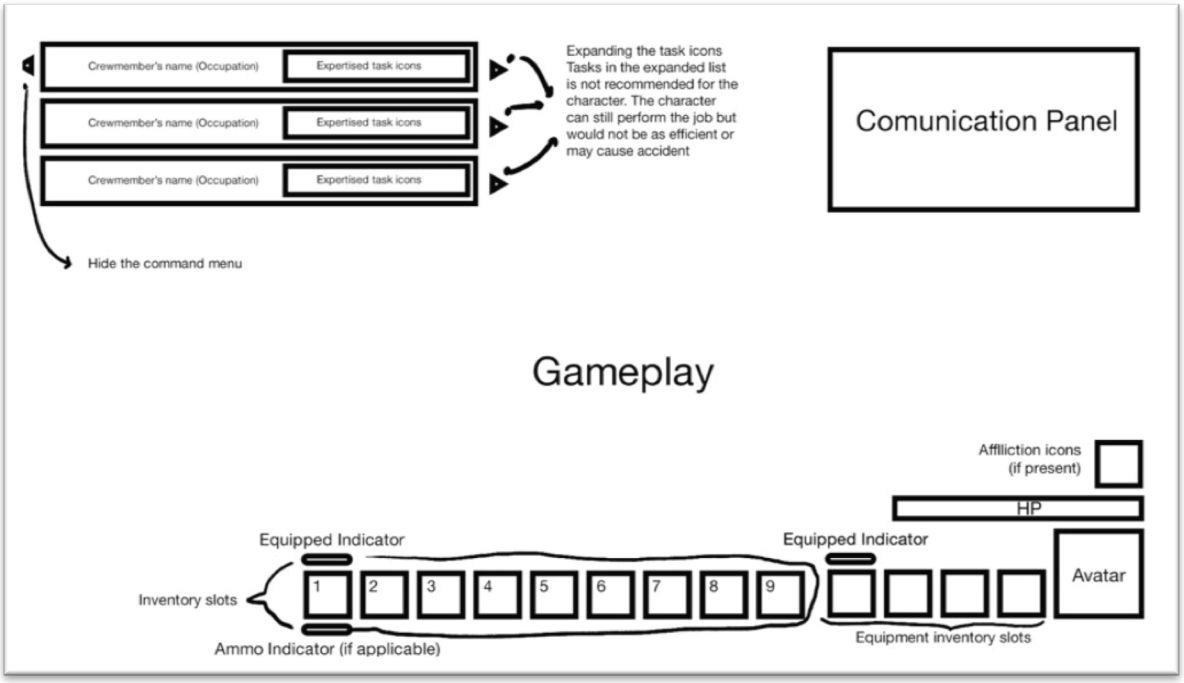


Mission screen wireframe

The mission screen allow players to choose their mission and prepare for it. Upon choosing a location on the map, the two dialogues for picking mission and shopping or crew management will show up. Shopping and crew management are two tabs of the same dialogue as they share a similar purpose and layout

Appendix

3/2

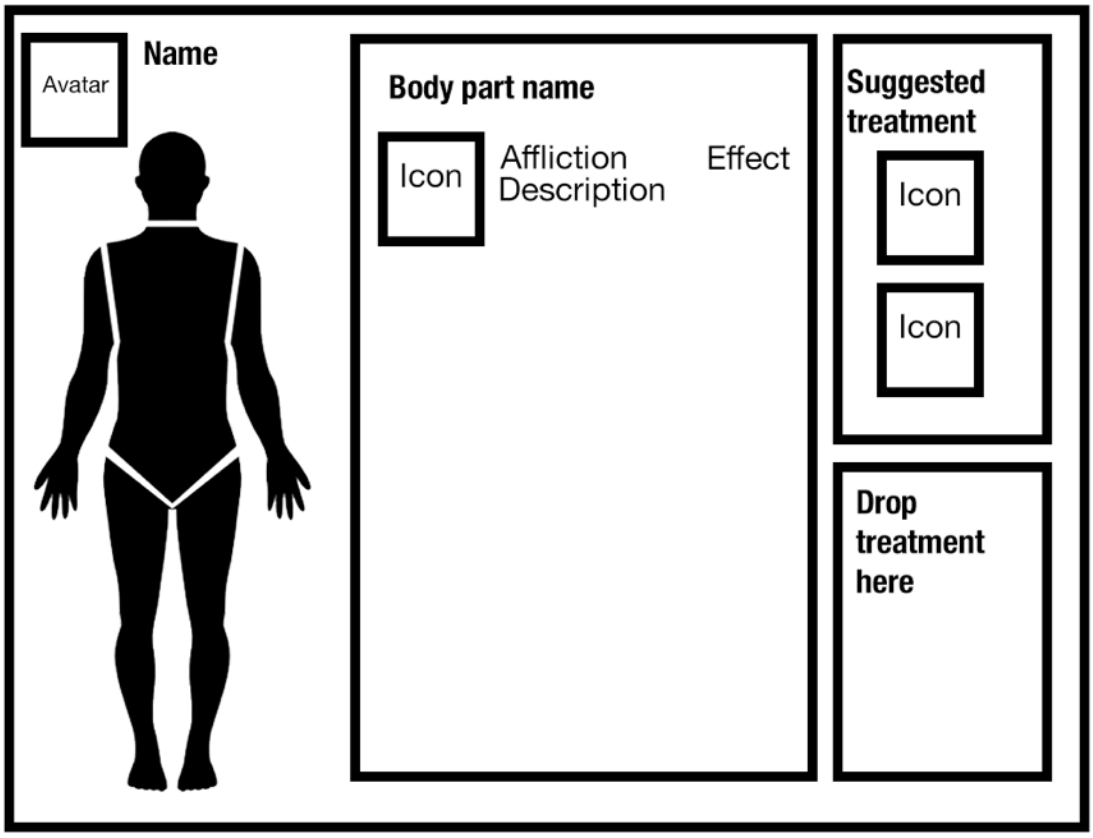


In-game wireframe

In-game UI including the command menu, the inventory system, character information, and the communication panel. While the communication panel and the command menu can be hidden, the inventory system and character information always present. In equipment slots function in the same manner with the inventory slots, although they cannot be accessed with a hotkey, and they can only contain specific families of object.

Appendix

3/3

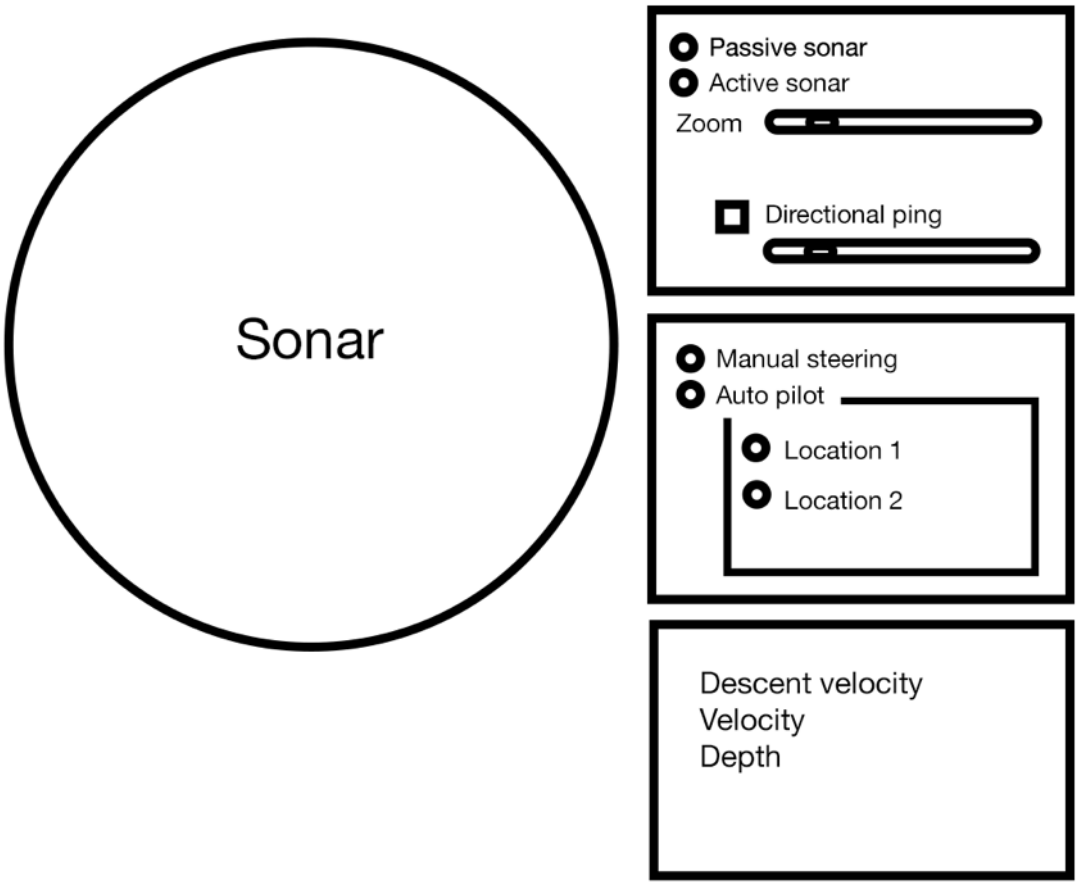


Medical interface wireframe

While the character information section of the in-game interface can give the players a general look of the character's status, the medical interface allows the players to have a more in-depth look of their character's medical situation. By clicking on a body parts of the human silhouette, specific afflictions on that body part will be presented. Medical treatments such as medicines or bandages can be dragged from the inventory to the "Drop treatment here" section.

Appendix

3/4

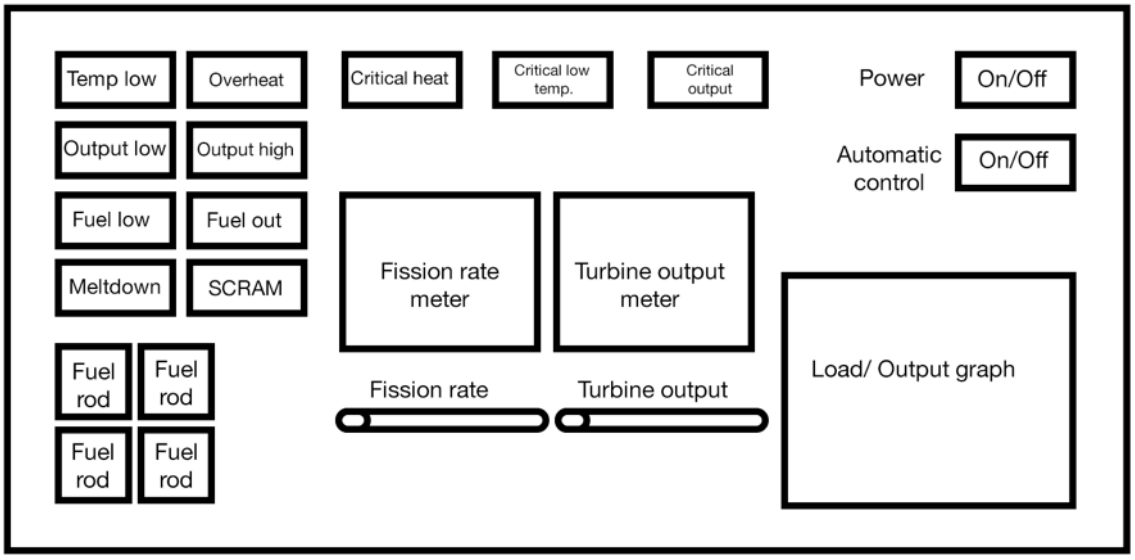


Navigator interface wire

Most of the control and environment information happen on the sonar, which uses the sonar graphic from the legacy version. Other control options and navigation are put to separate dialogues due to the customisable nature of this interface. Players can configure the interface to display more information and control options by adding more dialogues or expanding the existing one.

Appendix

3/5

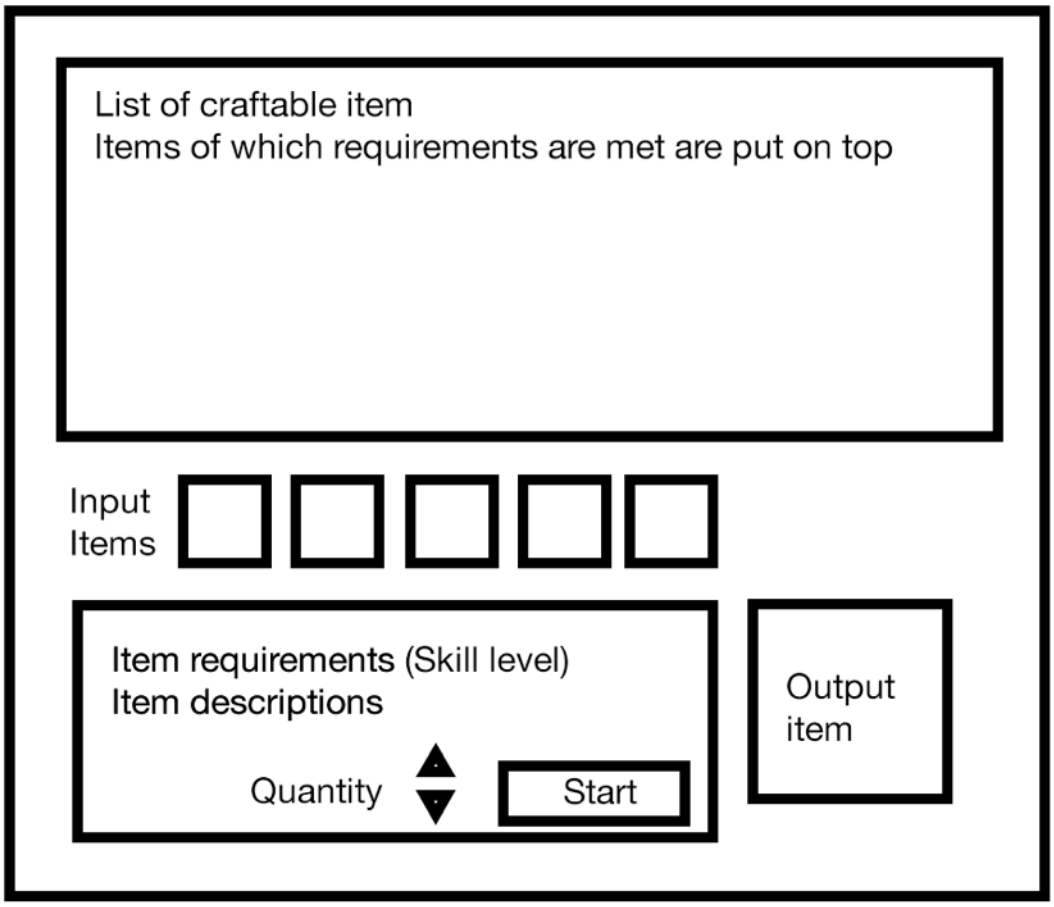


Nuclear reactor interface wireframe

While the nuclear reactor interface seems to be overwhelming, it mostly displaying information and does not require much interaction. The reactor status indicators will start flashing in designated situations, these require players to quickly interfere. If a negative status remains unfixed, the reactor will be in a critical situation, indicating by the critical status indicators.

Appendix

3/6

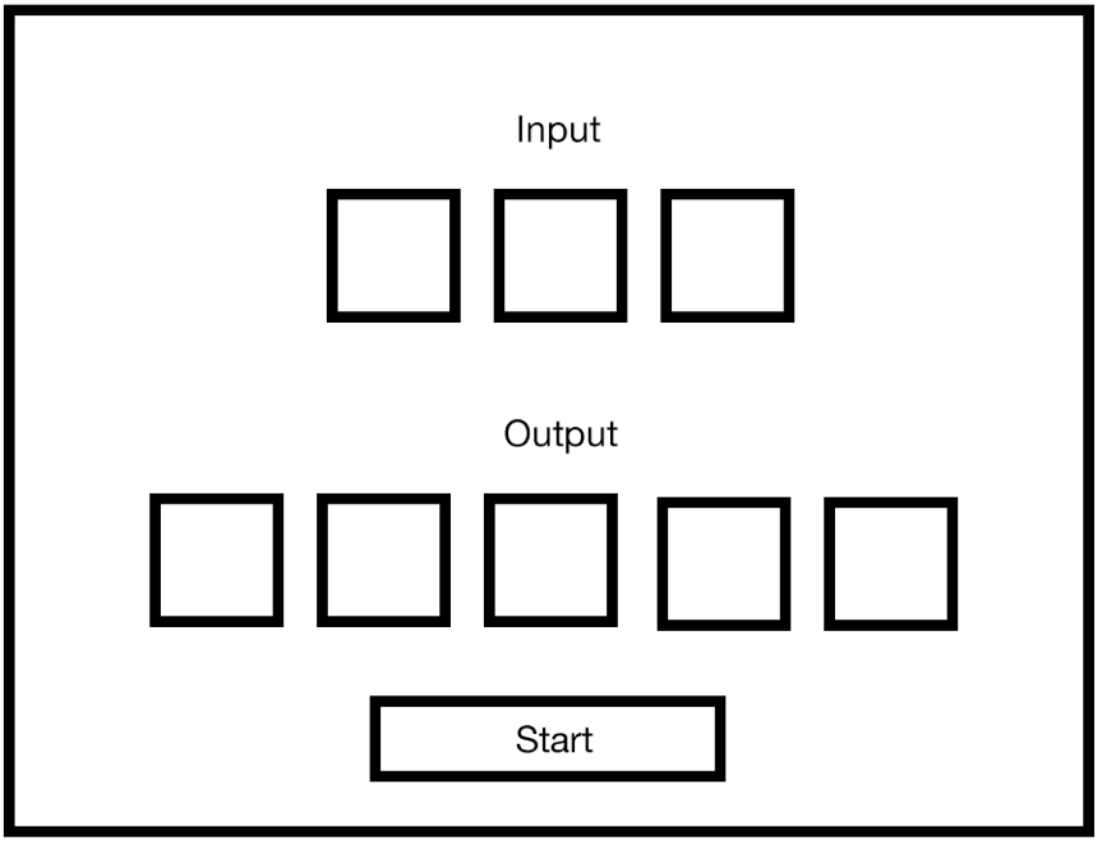


Fabricator interface wireframe

Fabricator interface is a straight forward system. By selecting an item to craft, players can see the required ingredients' icons grayed out in the input items slots. By double-clicking on them, these slots will automatically include the ingredients. The maximum number of output item is determined by the available ingredients.

Appendix

3/7



Deconstructor interface wireframe

Similar to the fabricator interface, the deconstructor interface is straight-forward. By dragging the items to the input slot, the output slot will display the results from deconstructing such items in a grayed out form. Upon clicking the “Start” button, the items in the output slots are now available to put to the inventory. Players can drag them to the inventory or can double-click on them. Alternatively, once there are items in the output slots without any item in the input slots, the “Start” button can be changed to “Take all” to allow players to gather the output items at onces.

Appendix

4/1

Barotrauma's user interface evaluation form

Please fill out this form after completing the play testing session.

*Required

1. **How experienced are you with Barotrauma?** *
   Mark only one oval.
   - ◯ Completely unexperienced
   - ◯ I watched other people played a few times
   - ◯ I played it myself a few times
   - ◯ I played it a lot

2. **Which tasks from the task list have you successfully completed** *
   Tick all that apply.
   - ☐ Hire a mechanic
   - ☐ Buy an oxygen tank
   - ☐ Choose a cargo mission
   - ☐ Assign a mechanic to turn nuclear reactor on
   - ☐ Switch to said mechanic and insert more fuel rods to the nuclear reactor
   - ☐ Switch to the captain deconstruct the revolver
   - ☐ Using the material got from the deconstruction to craft the revolver using the fabricator
   - ☐ Go to the room right next to the medical room to confront and kill the crawler using the revolver
   - ☐ Give yourself treatment after killing the crawler
   - ☐ Use the navigator to steer the ship to the destination

3. **What prevented you from completing such task (if there is any failed task)?**

Mission preparation UI

How agreed are you with these statements ?

Appendix

4/2

4. **It is easy for me to learn to operate the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

5. **It is easy to get the system to do what I want it to do** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

6. **The interaction with the system is clear and understandable** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

7. **The system is flexible to interact with** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

8. **It would be easy to be skillful at using the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

Appendix

4/3

9. **It is easy to use the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

10. **More comments?**

Command user interface

How agreed are you with these statements ?

11. **It is easy for me to learn to operate the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

12. **It is easy to get the system to do what I want it to do** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

13. **The interaction with the system is clear and understandable** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

14. **The system is flexible to interact with** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

15. **It would be easy to be skillful at using the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

16. **It is easy to use the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

17. **More comments?**

Inventory user interface

How agreed are you with these statements ?

18. **It is easy for me to learn to operate the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

19. **It is easy to get the system to do what I want it to do** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

Appendix

4/6

25. **It is easy for me to learn to operate the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

26. **It is easy to get the system to do what I want it to do** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

27. **The interaction with the system is clear and understandable** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

28. **The system is flexible to interact with** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

Appendix

4/7

29. **It would be easy to be skillful at using the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

30. **It is easy to use the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

31. **More comments?**

Navigator user interface

How agreed are you with these statements ?

32. **It is easy for me to learn to operate the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

Appendix

4/8

33. **It is easy to get the system to do what I want it to do** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

34. **The interaction with the system is clear and understandable** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

35. **The system is flexible to interact with** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

36. **It would be easy to be skillful at using the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

37. **It is easy to use the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

38. **More comments?**

Nuclear reactor user interface

How agreed are you with these statements ?

Appendix

4/9

39. **It is easy for me to learn to operate the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

40. **It is easy to get the system to do what I want it to do** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

41. **The interaction with the system is clear and understandable** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

42. **The system is flexible to interact with** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

43. **It would be easy to be skillful at using the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

44. **It is easy to use the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

45. **More comments?**

Fabricator/Deconstructor interface

46. **It is easy for me to learn to operate the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

47. **It is easy to get the system to do what I want it to do** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

Appendix

4/11

48. **The interaction with the system is clear and understandable** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

49. **The system is flexible to interact with** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

50. **It would be easy to be skillful at using the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

51. **It is easy to use the system** *
Mark only one oval.

	1	2	3	4	
Totally disagree	◯	◯	◯	◯	Totally agree

52. **More comments?**

It's almost done!

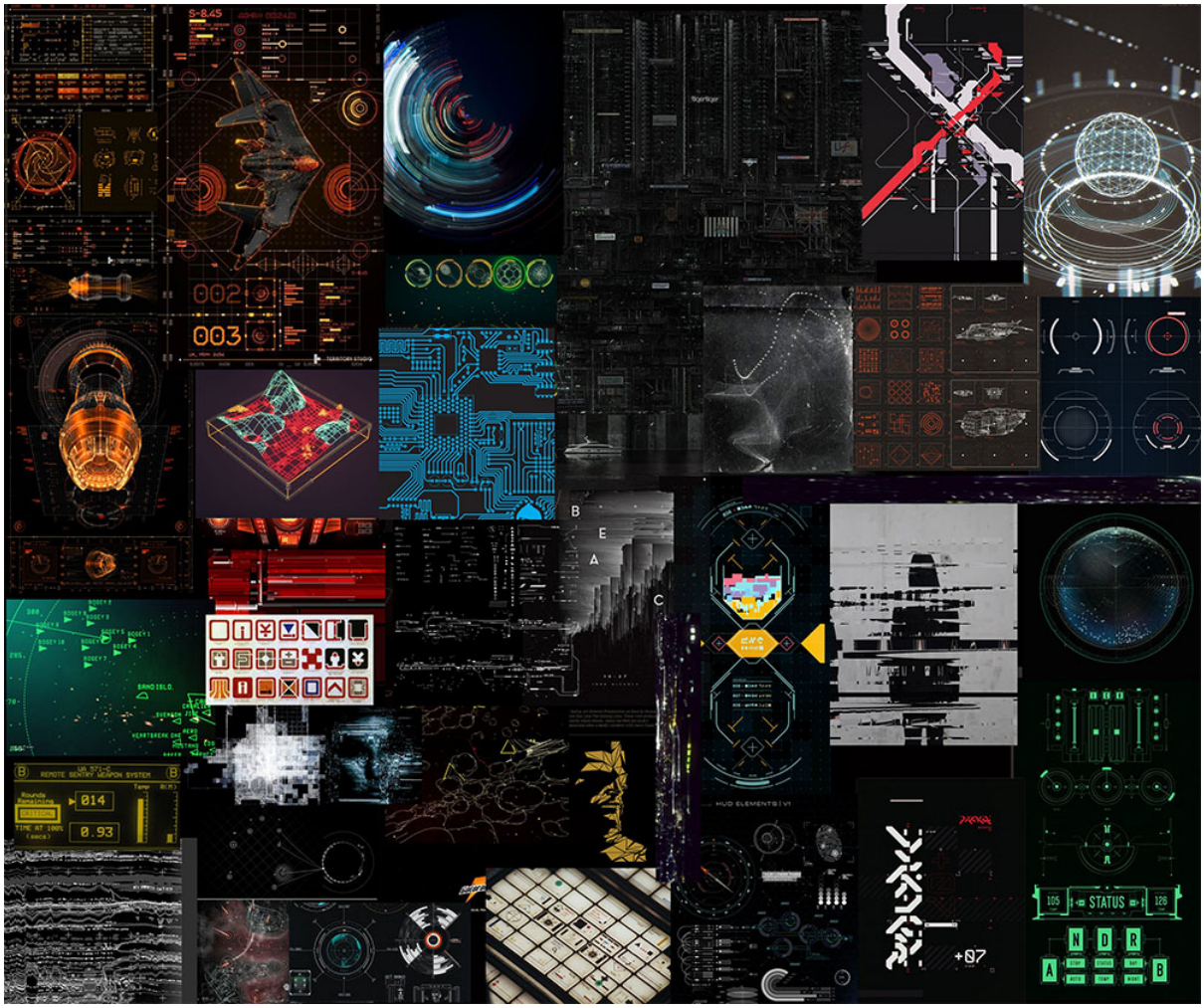
53. **Any comment or suggestion?**

Powered by Google Forms

Appendix

5/1

UI MOOD-BOARDS



Appendix

5/2


CH 2
CH 1
MIC
AUX
POWER
MASTER 1
MASTER 2
BOOTH
USB


AMADA-O+P+C


u-he
REPRO-1


AMADA-FANUC-P


LOADING BAY
01
A/01
HOLD
VOL
G67.709E./U.S
PULL
OUTER DOOR OPEN
P/A
233/R/7D

Appendix 6

DIALOGUE BACKGROUND CONCEPT

A

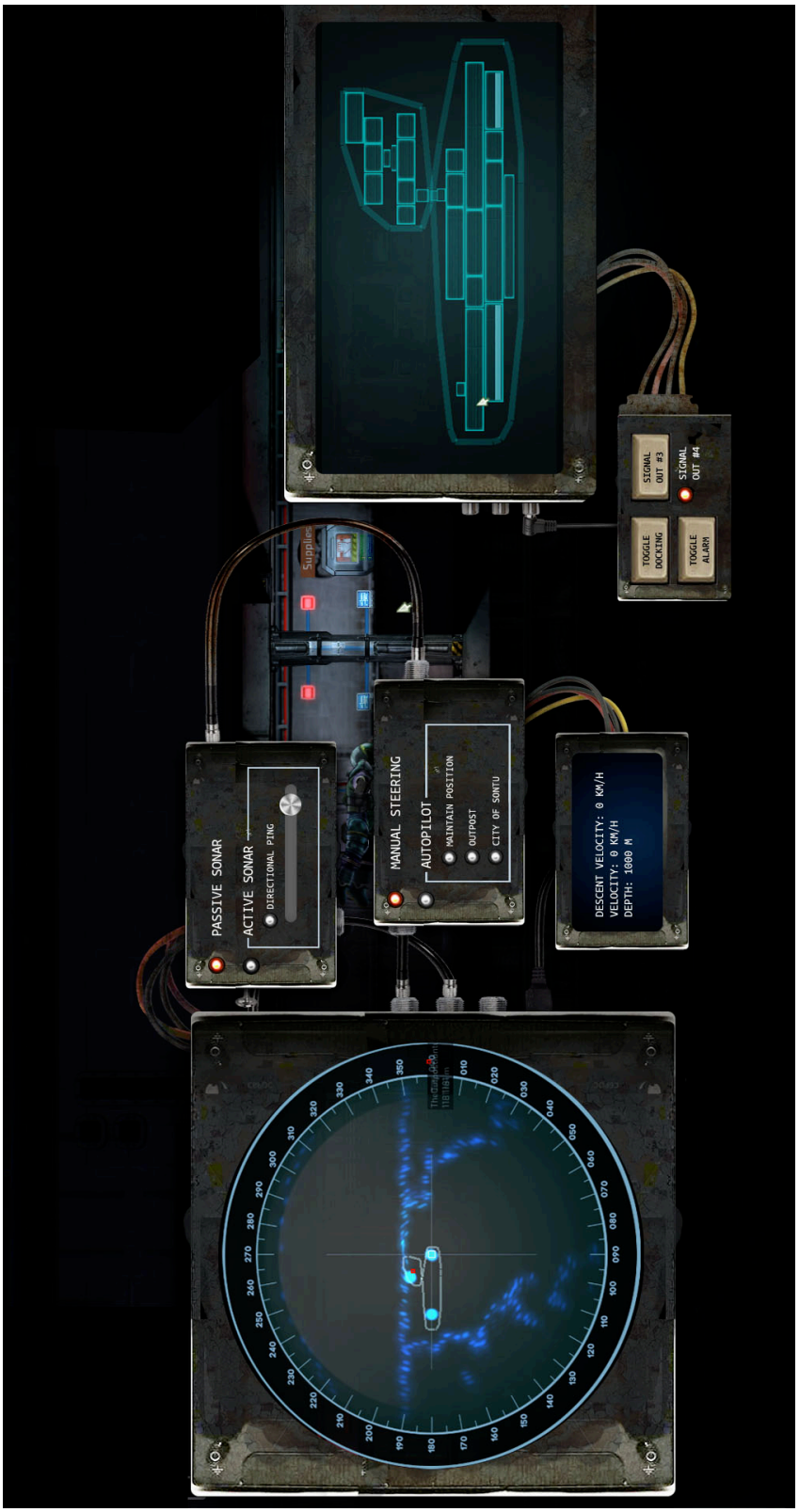
B

Appendix 7

UI CONCEPT ARTS

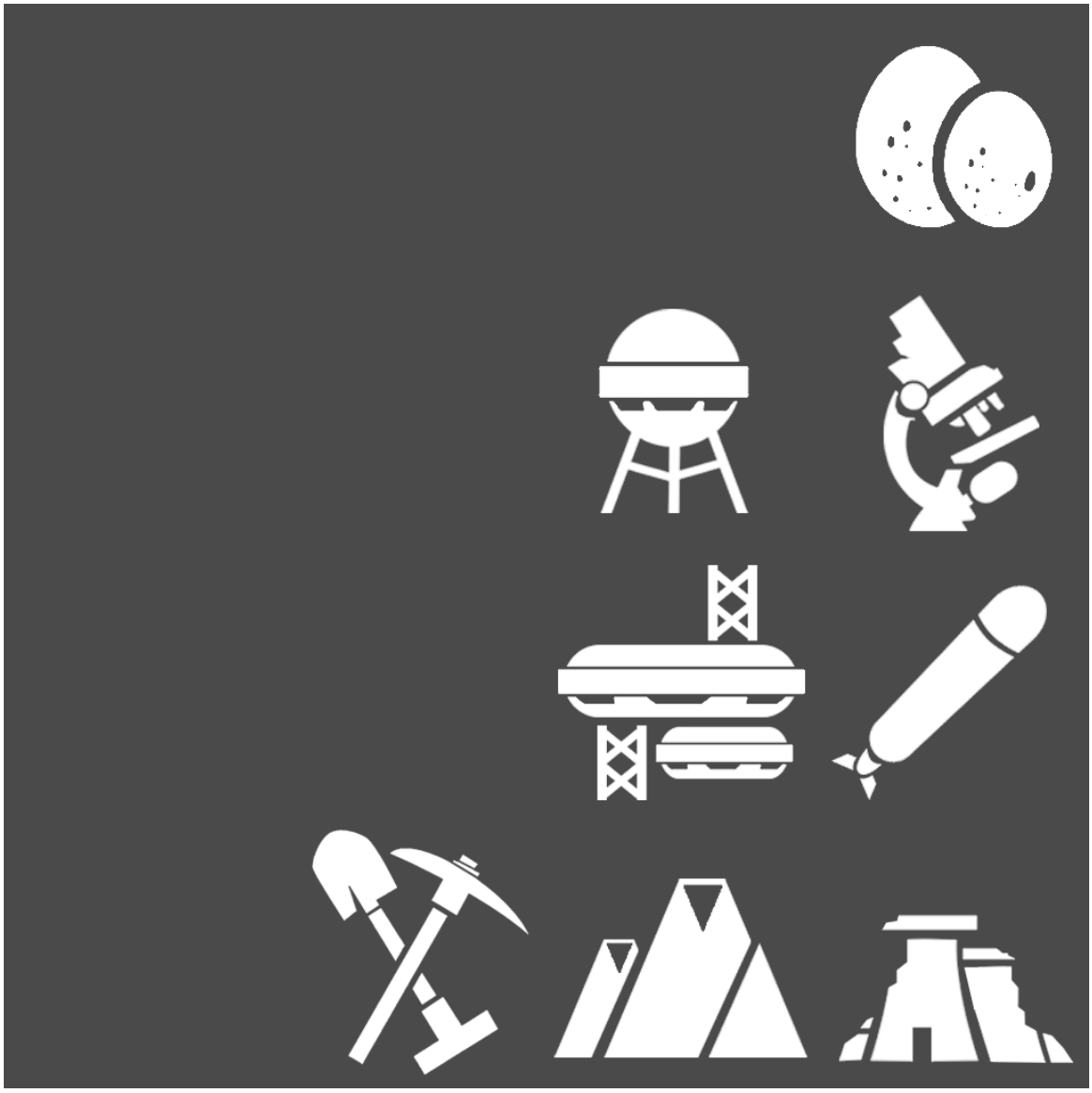
Appendix 8

NAVIGATOR UI CONCEPT ART



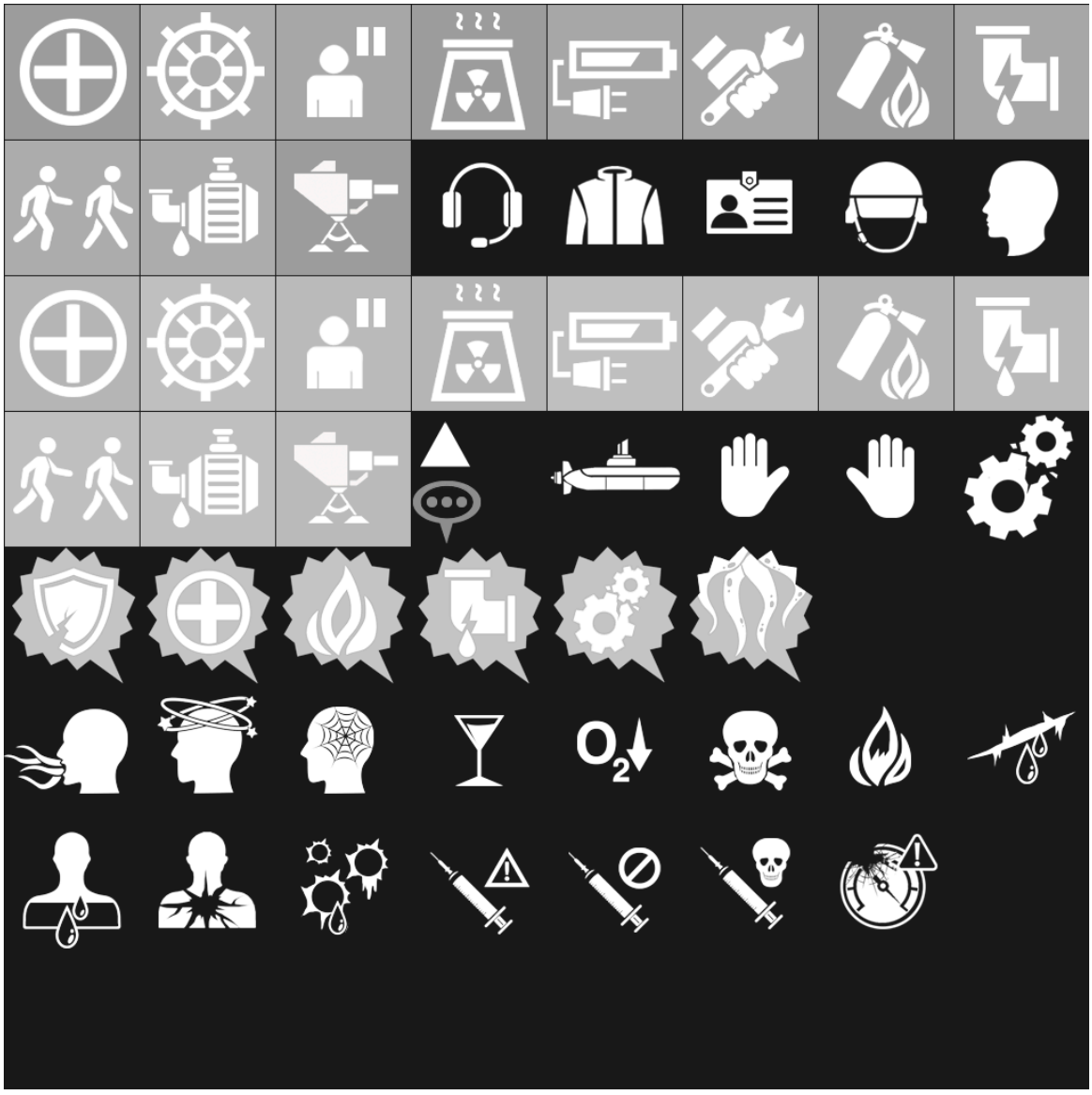
Appendix 9

LOCATION ICONS ATLAS



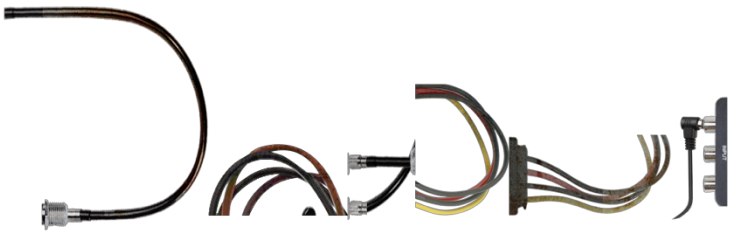
Appendix 10

IN-GAME ICONS ATLAS



Appendix 11

COSMETIC & INTERACTIVE ELEMENTS ATLASES



Appendix 12

DIALOGUE BACKGROUND ATLAS