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Design of User Agency in Interactive Narrative

Master's thesis in Master in Interaction Design

Supervisor: Mariusz Nowostawski

June 2019

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Preface

This is a master thesis in Interaction Design at the department of Design at the Norwegian University of Science and Technology (NTNU). The project planning and literature review were conducted during the autumn of 2018. The work presented in this thesis was conducted and written during the spring of 2019 and the workload corresponds to 30 ECTS.

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Abstract

IN is a significant property in the development of digital media. The demand for IN products and services with good user experiences is increasing in business, consumer market and public sectors. However, the study of design approaches of creating interactive digital narratives with desired user experience is still in its infancy. The project is intended to contribute a better user experience in IN systems from the perspective of user agency. It aims to have a deepened account of the concept of user agency, to investigate how to design the user agency, and to have a better understanding of the relationship between user agency and user experience. The user agency was defined as a satisfying power to be able to conduct the desired actions and cause the expected consequence for a certain intention after a comprehensive literature review on the concept of agency from the perspective of psychology, sociology, neuroscience and digital media in this research. A framework was implemented during the project, which summarized 3 key aspects need to be considered when designing user agency in IN systems: 1) Intention, 2) Action Selection, 3) Outcome Comparison. Approaches of designing user agency were summarized and mapped in the user-centered design process in the framework. The framework was validated by an experiment which shows that the user agency of the IN system redesigned based on the framework was significantly better than the original one without the guidance of the framework. The experiment also found that there is a moderate positive correlation between user agency and user experience.

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1 Introduction

Digital technologies provide a platform for an interactive and dynamic narrative experience which can be created and influenced through audiences' decisions and actions. This digital narrative experience is referred to as Interactive Narrative (IN) [1]. IN is a significant property in the development of digital media in formats such as games, VR/AR applications, interactive cinema and interactive documentary; and domains such as education, training and entertainment.

The demand for IN products and services with good user experiences is increasing in business, consumer market and public sectors. However, the study of design approaches of creating interactive narratives with desired user experience is still in its infancy. [2]

This study is intended to explore approaches to improve the user experience of IN from the aspect of User Agency. user agency is often considered as user's capacity to act and make a distinction in digital media. Hypothetically, it can provide users with a positive feeling of being in control of their decisions and actions, which can contribute to satisfying user experience. The concept of user agency is commonly considered as a key to many successful games and other works of playable media in related works. However, there are still some essential questions remaining underdeveloped, such as how to define the user agency explicitly, how users perceive the sense of user agency, how to design the user agency and what's the relationship between user agency and user experience. This study is trying to tackle these questions in the context of IN and contribute to the development of both user agency and user experience in IN.

1.1 Topic covered by the project

The project is intended to contribute a better user experience in IN systems from the perspective of user agency. It aims to have a deepened account of the concept of user agency, to investigate how to design the user agency, and to have a better understanding of the relationship between user agency and user experience.

To achieve these purposes, the project first started with a comprehensive literature review on the concept of agency from the perspective of psychology, sociology, neuroscience and digital media to understand what is agency and how humans perceive it. Then the notion of user agency in this study was defined and 3 main aspects which influence the perception of agency were concluded. Theories on how people select actions and build links between actions and outcomes were reviewed to summarize approaches of designing user agency in terms of these 3 aspects. After that, the relationship between user agency and story, computer models and interfaces were investigated to have a better understanding of designing the user agency in the context of IN systems. Metrics and methods of evaluating the user agency and user experience of IN were also reviewed and concluded as a guideline for experiment design in the methodology section.

Finding from the literature review were used to develop a frame which contains key aspects should be considered when designing user agency and approaches which can be used to design and evaluate the user agency in IN systems.

A case study of an existing IN system was followed up to bridge the gap between theoretical research and design conventions in IN systems. The IN system was redesigned based on the built framework. A prototype of the redesigned version of the IN system was created and be compared with the original version in an experiment to validate the built framework and investigate the relationship between user agency and user experience.

1.2 Keywords

Sense of Agency; User Agency; Interactive Narrative; Narrative Experience; Play Experience; User Experience

1.3 Problem description

One of the core aspects of an engaging narrative experience is a coherent story progression. In a coherent narrative experience, all events build off prior events reasonably until a conclusion is reached, following author conceived criteria. These author-conceived criteria include but are not limited to the narrative structure, principles of dramatic tension, pedagogical goals, or other considerations [1].

IN systems provide audiences with a unique and engaging narrative experience which allows them to act and make a distinction during the story unfolding process. However, the capability of making distinction brings up challenges to a coherent story progression. In IN systems, audiences have more freedom and can make decisions and influence the narrative in their own preferred manner, which may unintentionally make the story incoherent and even cause certain plots impossible to be progressed. For example, if an audience decides to kill a character who plays a key role in narrative progression, the story line then cannot continue as expected.

To solve this conflict in IN, there are mainly two approaches. The first approach is to expand the capabilities of computer models to support more freedom of users' activities in IN systems and adjust the narrative automatically based on users' actions. With the development of AI technologies, many studies try to approach this conflict from the perspective of the narrative intelligence, including technologies like story understanding, story generation, drama manager, player modelling [1]. These technologies expanded the possibilities of different actions and interventions users can take in the IN, but IN systems with current technologies are still far away from achieving the goal of fully fulfil users' freedom.

The second approach is to restrict users' activities in IN in a reasonable manner to ensure a coherent narrative experience while not have bad influences on the user experience. Greater freedom doesn't always result in better user experience. Even though AI technologies eventually provide users with fully free will to interact with all aspects of IN systems, users will still easily get lost if they do not know what to do and what to expect. On the other hand, too many restrictions on activities in IN can reduce users' choices and sense of control, which leads to a less appealing and

engaging experience.

An ideal solution to solve the conflict in coherent narrative experience and users' freedom should be a mix of both of these two approaches: First, understand users' intentions in different contexts; and then restrict available actions based on the intentions, and after that implement and support the available actions with technologies.

The concept of user agency is closely related to how users make decisions and choose actions. Therefore, a better understanding of user agency can hypothetically contribute to solving the conflict. However, there are still some essential questions remaining underdeveloped, such as how to define the user agency explicitly, how users perceive the sense of user agency, how to design the user agency and what's the relationship between user agency and the user experience. By investigating these questions in the context of IN, it can contribute to the development of both user agency and user experience of IN systems.

1.4 Justification, motivation and benefits

IN is a significant property in the development of digital media. Knowledge about IN design can be applied in many areas, such as (serious) games, television, journalism, museums, education, public awareness campaigns, etc [1]. The demand for IN products and services with good user experiences is increasing in business, consumer market and public sectors. However, the study of design approaches of creating interactive digital narratives with desired user experience is still in its infancy. [2]

The project is intended to contribute a better user experience in IN systems from the perspective of user agency. It aims to have a deepened account of the concept of user agency, to investigate how to design the user agency, and to have a better understanding of the relationship between user agency and user experience. The aspect of user agency is a key role to tackle the conflict of coherent narrative experience and users' free will in IN systems. Answers of how to define the user agency explicitly, how users perceive the sense of user agency, how to design the user agency and what's the relationship between user agency and the user experience will have crucial influences and give important insights on developing the future interactive systems.

The planned research outcomes are intended to benefit a deepened account the concept of user agency, build a framework of designing user agency in IN system and find out a clearer relationship between user agency and user experience in IN.

1.5 Research questions

The research questions and sub-questions to be addressed in the research project are:

- Q1: How to define User Agency?
- Q2: How can we design the User Agency in Interactive Narrative?
 - Q2.1: What aspects should be considered when designing the User Agency?
 - Q2.2: How to design the User Agency in the context of Interactive Narrative?

- Q3: What's the relationship between User Agency and User Experience in IN systems?
 - Q3.1: What aspects should be considered when evaluating the user agency in the Interactive Narrative Systems?
 - Q3.2: What aspects should be considered when evaluating the user experience in the Interactive Narrative Systems?

1.6 Planned contributions

The planned contributions contain 3 parts. The first part is to have a clear definition of the concept of user agency.

a clear definition of the concept of user agency, a framework contains key aspects and design approaches of designing user agency in IN systems, and the relationship between user agency and user experience in IN.

The second part is to a framework contains key aspects and approaches of designing user agency in the context of IN, which will allow other designers, writers or researchers to use and improve in their works.

The third part is to create a prototype based on the framework and evaluate the user agency and user experience of it. The evaluation will be used to validate the build framework and to investigate the relationship between user agency and user experience in IN.

2 Related Works

Through the literature review, the researcher intended to have further knowledge of the research questions. In terms of the first research question (Q1), the researcher reviewed and compared notions of agency from psychology, neuroscience and digital media in section 2.1. Based on the review, the notion of user agency in this research is defined as a satisfying power to be able to conduct the desired actions and cause the expected consequence for a certain intention.

In terms of the second research question (Q2), the researcher reviewed and summarized import factors that influence the perceptions of user agency to find out what aspects should be considered when design a better user agency in section 2.2 and 2.3.

To answer the third research question (Q3), methods of evaluating the user agency and user experience of IN were reviewed and concluded in section 2.4, which were later used in the empirical studies of this study.

2.1 Defining the User Agency

Researches of agency exist in many disciplines including philosophy, psychology, sociology and digital media. The notion of agency is not always consistent in these disciplines. To have a better understanding of the user agency and determine a clear definition of user agency in this research, the researcher had a review of the notion of agency in the existing literature.

2.1.1 Sense of Agency

Imagining a daily scene that you are now thirsty and then you grasp a glass of water and drink it. In this given situation, you intentionally carry out a series of actions to satisfy your thirst and the consequence of the executed actions achieves your intention — you are not thirsty anymore. Moore [3] concluded this feeling of having control over one’s own actions and their consequences as the “Sense of Agency” based on his review of related researches on agency.

Chambon et al. had an explicit explanation of how do humans perceive the sense of agency from the neuroscientific view. In their work [4], they stated that the human brain computes the sense of agency both retrospectively and prospectively.

The retrospective view emphasizes that the sense of agency is computed by the brain when the outcomes of the external events are consistent with the internal predictions of action outcomes. This account is based on the “Comparator Model” developed by Frith et al. [5] and Frith [6], that the angular gyrus in the parietal cortex computes a perturbed sense of agency when a mismatch occurs comparing the predicted outcomes of action against its actual outcomes. The brain imaging study conducted by Chambon et al. [4] shows the evidence of the “Comparator Model” that though there is no clear positive correlation between the sense of agency and the brain area, the angular gyrus shows proportionate increasing activation as the subjective sense of agency decreases [7].

The prospective view emphasizes that the sense of agency is produced when people intentional select between alternative actions before they actually perform the actions, and this sense of agency is irrespective of whether subsequent intended outcomes occur or not [8]. In regard to this view, Wenke et al. [9] found that people feel a stronger sense of agency when they choose fluently and easily what to do. The brain imaging study conducted by Chambon et al. [4] also shows the evidence that the lateral prefrontal cortex, which is responsible for selecting between alternative actions, has a negative correlation with the angular gyrus activation when difficulty and conflict occur during the action selection process. Similar to the last brain imaging study, no correlation was found between the lateral prefrontal cortex and the angular gyrus activation when the action selection process is easy and efficient.

These findings suggested that the positive sense of agency is the default state in the neural networks and when the inconsistency of predicted outcomes and actual outcomes or the difficulty in actions selecting process is experienced, less sense of agency will be perceived.

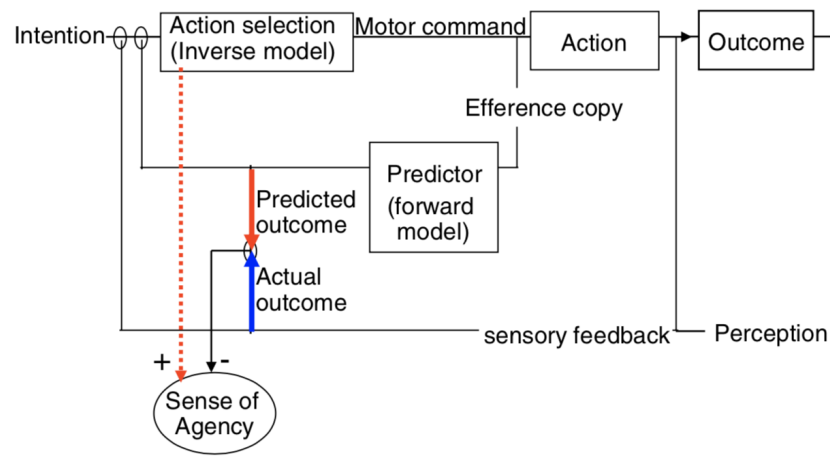


Figure 1: Chambon et al's computational motor control frameworks [7]

Figure 1 shows Chambon et al's computational motor control frameworks [7] which includes both the retrospective and prospective way to compute the sense of agency. The motor control system is a complex process that involves the brain, muscles and limbs [10], it explains how humans use their brain and cognition to activate and coordinate the human actions from a computational perspective. As shown in Figure 1, the Action Selection module selects an appropriate action based on the intention, and then generate a motor command to execute the action. A Predictor module predicts the outcome of the action, and the generated predicted outcome (the red arrow) is compared to the actual outcome (the blue arrow) reported by the sensory feedback. The inconsistency of the comparison will cause a decrease in the sense of agency. The action selection process generates a second prospective signal which directly contributes to the sense of agency (dashed red

arrow). An easy and fluent action selection leads to a stronger sense of agency [10].

Chambon et al's computational motor control framework matches Moore's notion of the sense of agency and sheds light on how people perceive the feeling of controlling of one's own actions and their consequences. When people are able to select desired action to achieve an intention, they will have a feeling of controlling their own actions. And when the outcomes of the actions match people's predicted outcomes, they will have a feeling of controlling the consequences of actions.

2.1.2 Player Agency

The concept of agency in games and other playable digital media is referred to as the "Player Agency". The player agency has been widely discussed among the game scholarship and game design industry, though there are not so many empirical works related to this concept.

Murray's Player Agency: Intention, meaningful action and result

Murray's definition of the agency is influential in the field of digital media and is widely referred to in the game scholarship. In her book *Hamlet on the Holodeck* [11], she described the player agency as "the satisfying power to take meaningful action and see the results of our decisions and choices". Murray's player agency is not simply participation or activity. She argued if players are kept conducting actions which are not chosen by the player and the effects are not related to players' intentions, it is not an experience of agency. Instead, chess is considered as a high-agency experience by her, because players take actions intentionally and see results [11]. These opinions and the definition suggest that to perceive the player agency, players need to 1) have an intention, and 2) take the meaningful action, and 3) see the results of the action. The second setup also implies players select an action which is meaningful. In conclusion, Murray's concept of player agency is similar to Chambon et al's computational motor control framework of the sense of agency, but she didn't consider the situation that if the seen results of an action do not match players' expectations.

Church's Player Agency: Intention, Predictable Consequence and Perceivable Consequence

Church didn't directly define the player agency, but he used the terms "Intention" and "Perceivable consequence" to describe a very similar concept in games [12]. The term "Intention" refers to the process of a player accumulate goals, understand the game world, make a plan and act as the plan while the term "Perceivable consequence" refers to the clear reactions from the game world to players' actions [13]. The combination of these two concepts seems to be very similar to Murray's three steps to perceive player agency (have an intention, take the meaningful action and see the results of the action), but it takes one step further as Church argued that the key to get players invested, involved and feel in control of the situation is they know what to expect from the world [13]. He gave the example using the commonly known game *Super Mario* that the consistent controls and physics in the game make the outcome of actions predictable. Players accumulate the knowledge like how to make Mario jump, and how high and how far he can jump while playing the game, which allows them to predict whether Mario can jump up to a platform or jump over a gap, and select the appropriate actions to achieve the predicted outcomes. These opinions suggest Church has considered the influence of predictable consequences in perceiving

the sense of agency in playing. In conclusion, Church's "Intention" and "Perceivable Consequence" suggest to perceive the player agency, players need to 1) have an intention, and 2) make a plan (predicate consequences and select the appropriate action), and 3) perceive the consequence (and compare it with the predicated consequence), which is very closed to Chambon et al's computational motor control framework of the sense of agency.

2.1.3 Summary

Based on Moore's definition of sense of agency, Chambon et al's computational motor control framework of sense of agency, Murray and Church's definitions of player agency, the User Agency in this research is defined as:

A satisfying power to be able to conduct the desired actions and cause the expected consequence for a certain intention.

2.2 Design of User Agency

According to the notion of user agency defined in section 2.1.3, there are 3 essential aspects which play important roles in people's perception of user agency: Intention, Action Selection, Outcome Comparison. This section reviewed theories and methods about the design of User Agency from these three perspectives.

2.2.1 Intention

People's intention is the precondition of the action selection process as it determines the purpose of actions and makes actions meaningful. Without a clear intention, even though people have a high degree of free will to interact with objects, they often easily get lost and do not know which action to take and what outcomes to expect. Therefore, though the intention phase does not directly contribute to the production of the sense of agency according to Chambon et al's computational motor control frameworks, it should still be taken into consideration as an essential factor influences the perception of user agency and a better user agency requires a clear intention.

2.2.2 Action Selection

The intention restricts the range of meaningful actions to achieve the goal in the given situation, then the action selection process is to decide a more appropriate behaviour to perform to meet the goal. According to Chambon et al's computational motor control framework of sense of agency, a smooth and fluent action selection will result in a better sense of agency. Therefore, to design a better user agency, designers need to understand how to improve the fluency of people's action selection.

In Bandura's Social Cognitive Theory [14], human behaviour is situated within a system of triadic reciprocal causation with personal influences and the environmental forces, which implies that the selection of behaviour is dynamically influenced by the personal and environmental factors. For example, a person is thirsty and there are a bottle of soda and a cup of tea available in the environment. The person's hands were injured and he is not able to open the bottle of soda, so he chooses to drink the cup of tea. In this situation, the person's selection of actions to meet his need

is restrained by the available resource in the environment and his physical capabilities.

Bandura's Social Cognitive Theory concluded some key factors which affect people's choice of actions:

Behavioral Capability - This refers to the ability to perform an intended behaviour successfully, which requires to know what to do and how to do it. It derives from a person's physical conditions, prior knowledge (the prior knowledge is defined as observational learning, inferences from exploratory experiences, the information conveyed by verbal instruction, or innovative cognitive syntheses of preexisting knowledge, etc. in this research [15] [16]) and resources in the environment.

Self-efficacy - This refers to the level of a person's confidence and belief in his or her ability to successfully perform a behaviour in a given situation. Self-efficacy is influenced by a person's specific capabilities and cognitive, motivational, affective factors, as well as by the barriers and facilitators in the environment [15].

Outcome expectations - This refers to the anticipated consequences of behaviour. People anticipate the consequences of their actions before performing in the behaviour. The expectations derive from previous experience, current context and situation in the environment, the evaluation of one's behavioural capability and self-efficacy [15].

To conclude, if the person 1) has the capability to perform, and/or 2) feels confident to perform, and/ 3) has positive outcome expectations to, one or more actions available in the given situation which can 4) meet his or her intention, the action selection process can be considered easier and more fluent, which can contribute a more positive sense of agency.

Two approaches can hypothetically to achieve these goals. The first one is to conduct user research and design actions correspond with users mental models so that users know how to perform them, feel more confident when they perform them and know what outcomes to expect. Another approach is to use design elements, like text, interface, tutorial in the IN system, to suggest users how to conduct behaviour and what outcomes to expect.

2.2.3 Outcome Comparison

According to Chambon et al's computational motor control framework of sense of agency, a consistency between predicted outcomes and actual outcomes will result in a better sense of agency. Therefore, the next question needs to be tackled is how to improve the consistency between predicted outcomes and actual outcomes.

Similar to other conscious experience, the sense of agency is not an infallible reflection of the reality [3]. The sense of agency can be illusory and does not necessarily require the actual agency. A common example of this phenomenon is the "placebo buttons" on the traffic light which are mostly ineffective and the actual changing of the traffic lights are linked to timers (McRaney, 2013).

In this example, people predict the outcome of the action that after pressing the button the traffic light will change. The predication most-likely is based on the observation of how others use

the buttons and the consequence after their actions or from their own previous experience. Though the actual outcome is not caused by people's action, it happens after people's actions and matches their predicted outcomes and therefore the sense of agency is perceived.

This example has two indications. First, empirical evidence plays an important role in predicting the outcomes of actions. The process of prediction does not necessarily require an explicit understanding of how the underlying circuit system and the mechanics of the buttons work. The observation of the "changing of traffic lights" after "pressing the button" from previous experience is often enough to build the link between actions and outcomes, which is then used in the prediction. The second indication is the actual outcomes does not necessarily need to be caused by the actions. In the example, the traffic lights change because of the timer, but, because it is observed many times that after pressing the button the traffic lights will change, people build an illusory feeling that there is a causal relationship between the action and the outcome. The natures of how people build links between actions and behaviours are used in this case for the purpose of providing people with the sense of agency while keeping the traffic lights work in an organized way.

This example suggested two approaches which can hypothetically contribute the consistency of predicted and actual outcomes: 1) Facilitate people to develop links between certain actions and outcomes to make people's predict outcomes more accurate to the actual outcomes. 2) Learn how people link certain actions and outcomes, and present the actual outcomes which match their predict outcomes.

To use the first approaches, designers need to have an explicit understanding of how people link actions and outcomes. Thompson et al's Control Heuristic [17] suggest how people build connections between actions and outcomes. An objective relationship between the action and the outcome should be based on the extent to which the probability of the outcome after an action is different than the probability after no actions. Thompson et al stated that instead of estimating the probability, people rely on simpler, but not necessarily accurate, strategies to assess the connection between actions and outcomes. They proposed 3 simpler ways of judgment for a subjective connection or association between people's actions and the desired outcomes [17]:

A temporal association - This refers to an association relies on positive confirming cases, which means the number of times one's action is followed by the outcome. The more positive confirming cases observed, the higher probability will predict the same outcome after the action.

A shared meaning connection - This refers to a connection based on a similarity in meaning or previous association between the two elements. For example, having strong muscles and being able to lift heavy objects are elements that belong together or share associative meaning. Thus, when people see a muscled guy lift a certain heavy object, they are likely to see the associative meaning as the evidence for a stronger connection between the actions and outcome. And if people are with muscle themselves, they are likely to be more confident to predict a successful outcome when they lift the same object.

A predictive connection - This refers to a connection based on the confirmed outcome from the

predicted expectation. Prior expectations have an important influence on covariation judgments. Alloy and Tabachnik's model of covariation judgment [18] suggests that people rely on the interaction of prior expectations and current situational information to make covariation judgments. Thus, if people expect an outcome to follow from their actions and this occurs after the action, the outcome is seen have a stronger connection to the action. Otherwise, the perceived connection will be weaker. After the expectation has been confirmed, people are more likely to have the same predictive outcome of the action.

To sum up, if the outcome of an action 1) is observed many times, and/or 2) shares associative meanings with the action, and/or 3) has corresponded with the predicted outcome before, people are more likely to predict this outcome when they execute the same action.

The second approach requires user researches to find out the existing links between actions and outcomes in people's mental models.

The action execution process is also important to the consistency of predicted and actual outcomes because if the action is executed as it is expected, it is more likely to achieve the predict outcomes. The performance of the action is influenced by both the predict outcomes and feedback mechanisms [16]. The predicted outcomes guide the direction of the execution of actions and provide the internal standards for corrective adjustments [19]. The feedback mechanisms provide the external standards for corrective adjustments. People adjust their actions according to the internal and external standard and eventually achieve an outcome close to the predict outcome [20].

To conclude, if the person 1) has a correct link between certain actions and their outcomes, and 2) execute the actions successfully, it will have a higher chance that the predicted outcomes are consistent with actual outcomes, which can contribute a more positive sense of agency.

2.2.4 Summary

Figure 2 summarized the content of this section. As mentioned above, there are 3 essential aspects which play important roles in people's perception of user agency: Intention, Action Selection, Outcome Comparison. And to create a stronger sense of user agency, the goals are to 1) provide a clear intention, 2) make the action selection fluent and 3) make the outcome comparison consistent. Making the action selection fluent can be divided into 3 sub-goals: 1) Improve users' behavioral capability or decrease the difficulty of the behavior, 2) Improve users' confidence of performing the behavior, and 3) Understand users' expected outcome of the behavior. These sub-goals can be hypothetically achieved by conducting user research and providing a tutorial to help users know the way of performing certain actions, build more confidence of performing these actions and know better of what outcomes to expect.

Making the outcome comparison consistent can also be divided into 3 sub-goals: 1) Build links between certain actions and outcomes to help users predict outcomes more accurately, 2) Understand how users link certain actions and outcomes, and present the actual outcomes which match their predict outcomes and 3) Help users execute actions successfully. The first sub-goal can be achieved by building a temporal association, a shared meaning connection or a predictive connection between action and outcome. The second sub-goal can be hypothetically achieved by conduct-

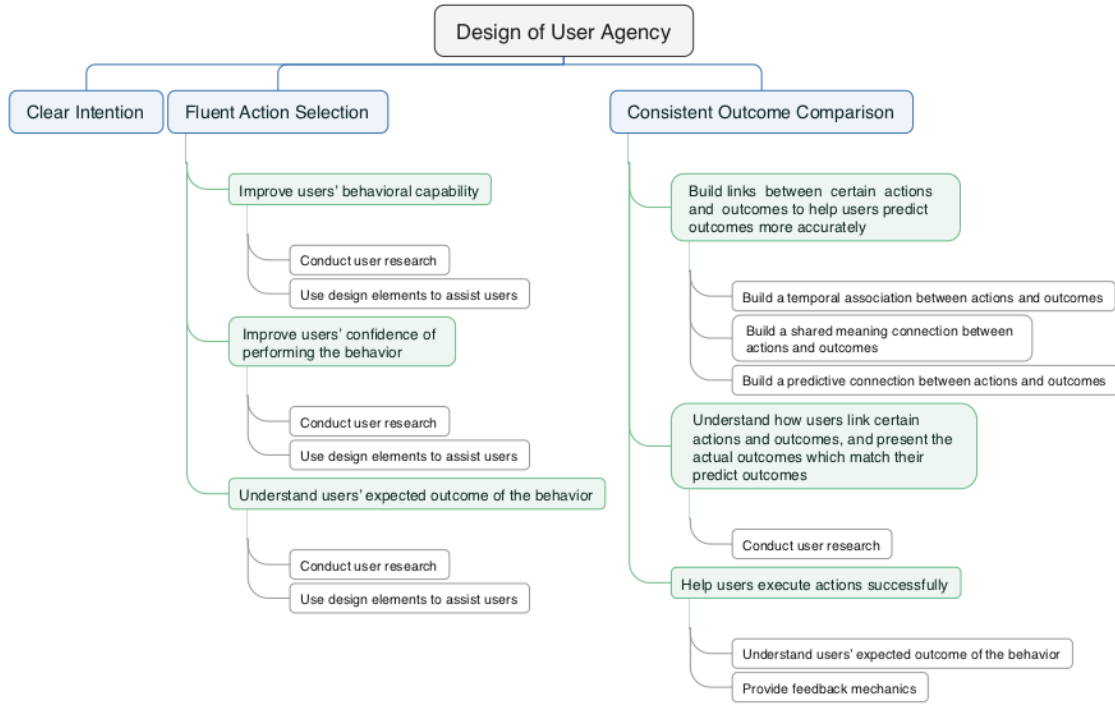


Figure 2: Summary of Section 2.2 Design of User Agency

ing user research to understand the existing links of actions and outcomes in users' mental model. The third sub-goal can be achieved by understanding users' expected outcome of the behavior and providing feedback mechanics.

These summarized approaches can be used in a generalized context. Approaches which can be specialized in the context of interactive narrative are investigated in the following section.

2.3 Design of the User Agency in the context of Interactive Narrative

Murray and Church both attempted to connect their accounts of user agency with the interactive narrative works.

Murray categorized ways to externalize the user agency in interactive narrative works, including spatial navigation, problem-solving, incorporating gameplay actions within the narrative, and traversing links in hypertext narrative [21], but these approach lacks explications of the relationship with the user agency, which leaves the catalogue underdeveloped [12].

Church criticized the way of involving stories in traditional role-playing and adventure games using his concept of "Intention" and "Perceivable Consequence". He pointed out that in these games, players form intentions, take actions and see consequences in the game system and gradually get familiar with what they can do and what outcomes they can achieve. But then they find out they

are unable to do so during the story progression, which doesn't match their predictions [13]. This inconsistency leads to bad play experience. The way of involving stories in traditional games which Church criticized is the cutscene. It is a non-interactive sequence to progress the story in the games and often breaks up the gameplay. The cutscene is gradually replaced by other ways of story progression which are more consistent with the gameplay system. This implies the bad experience caused by the inconsistent story progression in the gameplay from another perspective. To summarize, Church's opinions suggest a consistent game system plays an important role in involving stories into playable media. These attempts of combining stories and the player agency are largely approached in the form of examples. Wardrip et al. [12] concluded a more structural view of what factor matters in designing the player agency in interactive narrative systems, which contain three aspects: Story, Software Models, and Interface.

2.3.1 User agency and story

Mateas's work [22] approached the question of how to combine the story and the user agency by summarizing Murray's concept of agency and Brenda Laurel's adaptation of Aristotle's theory of drama [23] [24].

Laurel's work laid out a hierarchy of Aristotle's six qualitative elements of drama and combined two forms of causality from the neo-Aristotelian suggestion in this hierarchy. Figure 3 made by Mateas [22] shows the hierarchy. From bottom to above are layered enactment or spectacle, pattern, language, thought, character, action or plot. Of the two forms of causality, one runs down the hierarchy while the other runs up. In the upward direction, each element is the material cause of those above. In the downward direction, each element is the inferred formal cause of those below. An example made by Wardrip et al. [12] provides a simplified way to understand the material cause and formal cause that the materials of a chair like wood, nails, paddings are the material cause of the chair, while the idea of a chair is the formal cause of the being of the chair.

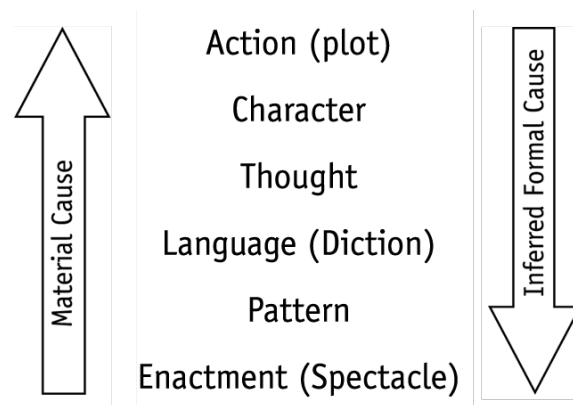


Figure 3: Laurel's hierarchy with two forms of causality. [22]

Mateas involved Murrays' concept of the agency at the point of the character in Laurel's hierar-

chy. The player is added to the hierarchy as a character who can choose his or her own actions. He proposed two new chains of causation which are specific to the player: User Intention and the Material for Action (See Figure 3). User's intentions become the formal cause of user's activities from the level of thought to spectacle, which influences the user's own thought, language and action. But the intention is not completely free will, it is constrained from above by the level of plot.

Another causality flows up from spectacle to user's actions. It provides the player with the material resources (material cause) for taking action. The material resources in an interactive narrative afford certain actions. They constrain what actions can be taken in the fictional world and make these actions obvious to carry out. These material resources can be thoughts, languages and behaviours of other characters, objects in the fictional environment, the interface of the interactive narrative system, etc.

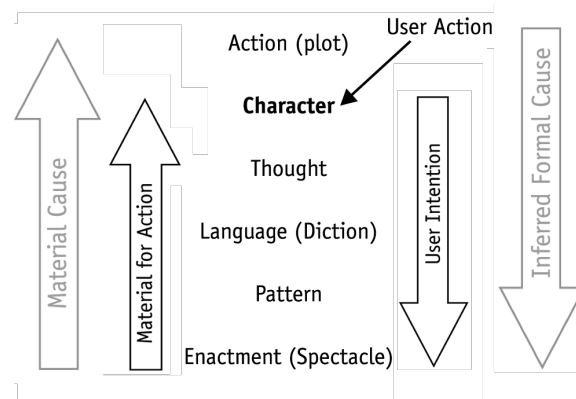


Figure 4: The hierarchy modified by Metecas with four forms of causality. [22]

Several ways to make the use of story elements in the design of user agency are concluded below:

- Intention
 - Use the plot in the story to give the user a clear intention.
- Action Selection
 - Use material affordances (other characters' languages, actions, objects in the environment, user interface) to suggest user what actions can be taken and how to do them to increase users' behavioral capability.
- Outcome Comparison
 - Use material affordances (other characters' languages, actions, objects in the environment, user interface) to help the player build links between actions and outcomes.

2.3.2 User agency and Software Models

Paul Dourish [25] argued that “Even in an immersive virtual-reality environment, users are disconnected observers of a world they do not inhabit directly. They peer out at it, figure out what’s going on, decide on some course of action, and enact it through the narrow interface of the keyboard or the dataglove, carefully monitoring the result to see if it turns out the way they expected. Our experience in the everyday world is not of that sort. There is no homunculus sitting inside our heads, staring out at the world through our eyes, enacting some plan of action by manipulating our hands and checking carefully to make sure we don’t overshoot when reaching for the coffee cup. We inhabit our bodies and they in turn inhabit the world, with seamless connections back and forth.”

This points out that people’s prior knowledge learnt in the real world to predict outcomes of actions, to select appropriate actions and to perform actions may not work in the fictional world. Players need to learn the rules of the fictional world which are defined by the underlying software model. As Church insisted, the software model should build consistent rules in the fictional world which allows players to gradually learn how the world works and be able to predict the outcomes of actions. With a well-supported software model, there is a higher chance to achieve a consistency of predicted outcomes and the actual outcomes of actions, which can contribute to the sense of agency according to Chambon et al’s computational motor control frameworks.

To summary, the software model can influence the design of user agency in the following ways:

- Action Selection
 - The software model provides a consistent rule of the fictional world. After players get familiar with rules, they will know better about how to perform the action, feel more confident to perform the action and know what to expect when performing the actions, which can result in a smoother action selection.
- Outcome Comparison
 - The software model provides a consistent rule of the fictional world and defines relationships between actions and outcomes, which helps the player build links between actions and outcomes.

2.3.3 User agency and Interfaces

A common assumption is that the higher sense of presence in the fictional world leads to a higher engagement of players. However, Dow’s empirical study [26] of investigating the sense of presence and the engagement of players in three versions of Mateas and Stern’s Interactive narrative system *Façade* gave a different answer. These three versions include a desktop version with keyboard controlled dialogue, a desktop version with voice-controlled dialogue, a fully-realized augmented (AR) version. The results showed an increased sense of presence as one commonly expected but the increased sense of presence didn’t result in increased player engagement. The higher sense of presence and the advanced interfaces provide players with a higher expectation of the system. They

predicted greater outcomes which beyond the ability of the underlying software model when they execute actions, and the actual outcomes cannot meet their expectations. As a result, they perceived a reduced sense of user agency which potentially leads to a lower sense of engagement. This results indicated that an interface represents the actual scope of the underlying software model allows the player to make more accurate predictions of available actions and outcomes of actions in the fictional world, which can contribute to the sense of agency. Moreover, participates from Dow's study also reported that the keyboard-based interface is easier to learn and to use than the voice-based interface. This is because people generally have more prior knowledge about the keyboard-based interaction than voice-based interaction. More prior knowledge is easier for the player to form intention and confidence to conduct actions and predict outcomes of actions. Therefore, a more familiar interface can also contribute to the sense of user agency.

To summary, the software model can influence the design of user agency in the following ways:

- Action Selection
 - The interface works as a material resource, indicate the player what to do and how to do it and hence increase the player's behavioral capability.
- Outcome Comparison
 - The interface reflects the capability of the underlying computer models and indicate the player what outcomes to expect, which helps the player have a more accurate outcome prediction.

2.3.4 Summary

This section investigated and concluded approaches can be used to design the user agency in the context of IN. These approaches are summarized and combined with approaches discussed in section 2.2 in Figure 5. As mentioned in section 2.2.4, to create a stronger sense of user agency, the goals are to 1) provide a clear intention, 2) make the action selection fluent and 3) make the outcome comparison consistent. In the context of IN, the story plot can be used to provide intentions for users to meet the first goal.

For the second goal, material affordances in IN like other characters' languages, actions, objects in the environment, the user interface can be used to suggest and imply users what actions to do, how to conduct them, what outcomes to expect to make the action selection process more fluent. Moreover, a consistent rule of the fiction world in the IN can also facilitate this goal.

Material affordances can be used to serve the third goal as other characters' languages, actions, objects in the environment, the user interface can be used to help users build links between actions and outcomes. A consistent rule of the fiction world ensures the link between actions and outcomes are consistent, which make it easier for users to build the link and to expect the outcomes accurately.

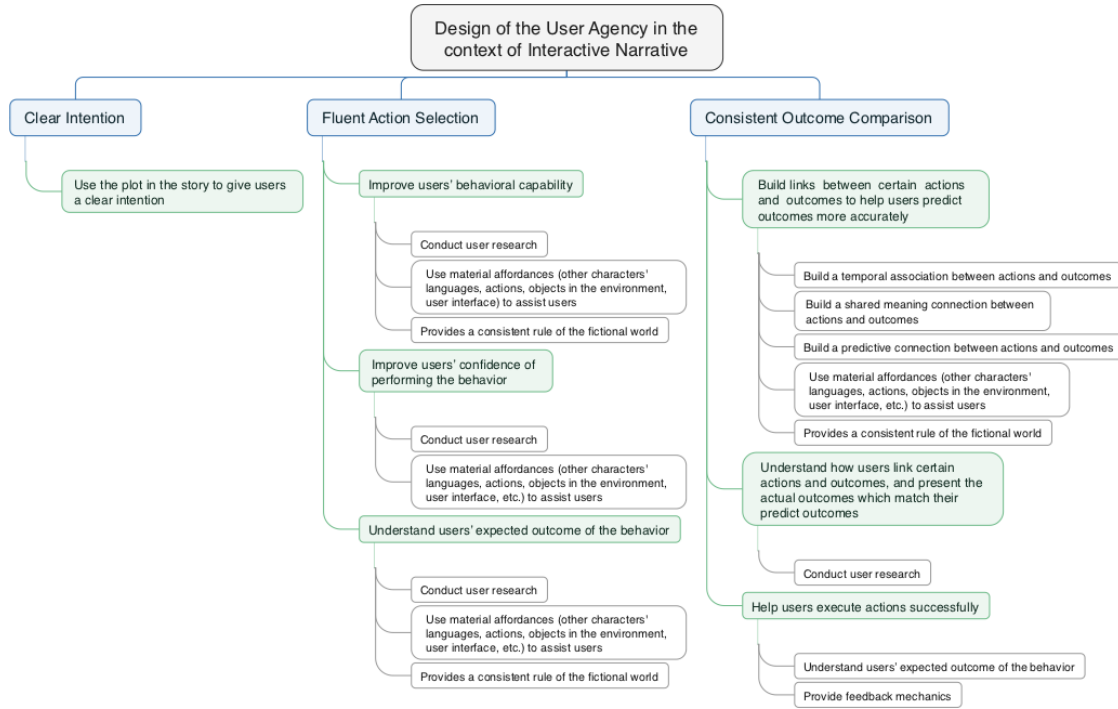


Figure 5: Summary of Section 2.3 Design of the User Agency in the context of Interactive Narrative

2.4 Evaluate the User Experience and User Agency of Interactive Narrative

2.4.1 User Experience of Interactive Narrative

The user experience of IN can be measured from several dimensions. Roth [27] concluded 14 dimensions of user experiences of IN which have a strong emphasis on the potential entertainment value of IN systems. He summarized these 14 dimensions into 3 categories: appreciation of interaction, appreciation of narrative, combined outcomes. These 14 dimensions include:

Usability - In the context of IN, usability can refer to experiences with the hardware (e.g. mobile, desktop, VR system) and the software interface. Usability is a precondition of perceived effectance, autonomy and satisfaction of user expectations [27].

Effectance - In IN, effectance is referred to as the effect a chosen action has. There are two levels of the effectance dimension: Local effectance (immediate effects of player's actions and decisions) and Global effectance (long-term effects of a story made by player's actions and decisions) [27].

Autonomy - Autonomy describes the feeling of freedom of a player to choose from a large set of possibilities in IN systems.

Flow - Flow refers to a strong feeling of engagement which blocks out external distractions in an activity [28].

Presence - Presence refers to the sense of being present in a fictional world, which implies being engaged, absorbed by the content of IN [27].

Character believability - Believability describes the degree of belief about non-player characters in the IN.

Identification - Identification refers to the degree of a player adopts the role he/she plays in the narrative setting [27].

Aesthetic pleasantness - Aesthetic pleasantness describes the sensory delight evoked by material and narrative elements in the IN experience, such as beautiful images, music, camera angles, narrative style, narrative content, character development, etc [29].

Curiosity - Curiosity refers to the player's interests in upcoming narrative events and outcomes of available actions in IN systems [27].

Suspense - Suspense describes the feeling of uncertainty and emotional involvement with characters or the overall narrative [27].

Satisfaction of expectations - The satisfaction of user expectations refers to player's expectations to the specific IN system and how well these expectations are met [27].

Positive and negative affect - Positive and negative affects refer to diverged affective states evoked by the narrative [27].

Enjoyment - Enjoyment is a positive experience and emotion [29], which describes a more broad experience of pleasure [27].

Figure 6 shows the categorized dimensions of user experience of IN.

Roth created detailed scales under each of these 14 experience dimensions. All scales are presented in the form of 5-point Likert scale, with the statement of the scale and the agreement ranging from “strongly disagree” to “strongly agree”. An adaption of Roth's scale (See Appendix A) is used to evaluate the user experience of IN systems in the empirical studies of this thesis. “N” denotes negatively framed items that need to be recoded when analyzing the data. “R” denotes items which are adopted by the researcher.

2.5 Evaluate the User Agency of Interactive Narrative

Roth further and Koenitz [30] further mapped Roth's scales under Murray's experiential qualities of agency, immersion and transformation [11]. Three dimensions were identified under the category of agency: Usability, Effectance and Autonomy. Roth's scales under these three dimensions were compared with the definition of user agency in this research, and a few scales were added into the scale to make it suitable for this research.

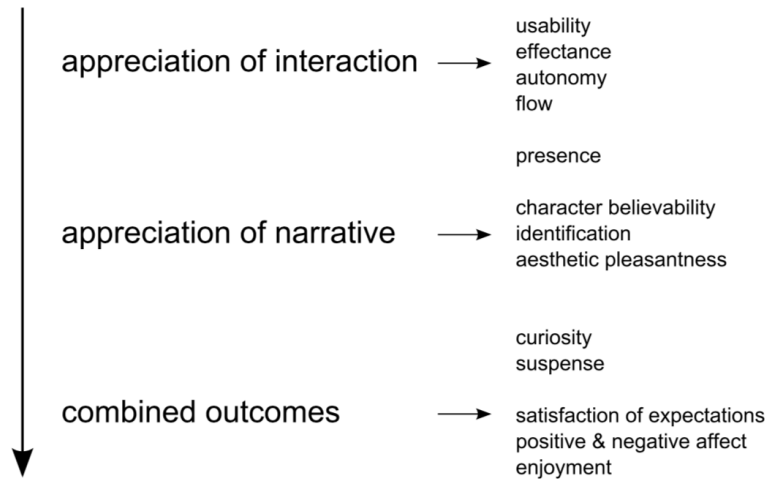


Figure 6: The hierarchy modified by Metecas with four forms of causality. [27]

Usability:

1. I thought the system was easy to use
2. I would imagine that most people would learn to use this system very quickly
3. I know how to select from different options in the system (R)

The scale 1 and 2 under usability reflect the general ease of use of the IN systems. They imply how easy for users to conduct the desired actions in the IN systems, which correspond to the definition of user agency in this research. The scale 3 was added to have a specific focus on how easy to make decisions in IN systems. It reflects the ease of action selection, which is a core aspect of the perception of user agency.

Effectance:

1. My inputs had a considerable impact on the events in the story
2. I had the feeling that I could directly affect something on the screen
3. My decisions clearly influenced how the story went on
4. My inputs had an impact on the events in the story in a way I expected (R)

The scale 1,2 suggests the local effectance of users' actions while scale 3 suggests the global effectance. These scales only considered the actual outcomes of actions but not the predicted outcomes of actions. Therefore, scale 4 was added as a complement to collect users' feeling about the consistency of the actual and predicted outcomes.

Autonomy:

1. I had the impression that I was able to make many different events happen in the story
2. I noticed many opportunities to influence the story

3. I felt strong limitations to my decisions how the story should proceed (N)
4. The system gave me precisely those options to influence the storyline that I had in mind

Scale 1 and 2 reflect users' capability of selecting actions and causing influence in the story. The scale 3 reflects the relationship of users' expected outcomes and the actual outcomes of actions. The scale 4 reflects the relationship between users' intentions and available actions in IN systems, which imply the ease of the action selection process (if none of the available actions meets users' intentions, it will be harder to make a decision among different actions). These three scales are all important aspects of the perception of user agency.

The adaption of Roth's scale under these three dimensions is used to evaluate the user agency of IN systems in the empirical studies of this thesis.

3 Methodologies

The methodology for this master thesis study consists the development a framework which guides the design of user agency in IN, a case study to evaluate and redesign the design of user agency with the built framework, and description of the experiment design, hypotheses to be tested, and how data was collected. The developed framework and the experiment are used to answer the research questions:

- Q2: How can we design the User Agency in Interactive Narrative?
 - Q2.1: What aspects should be considered when designing the User Agency?
 - Q2.2: How to design the User Agency in the context of Interactive Narrative?
- Q3: What's the relationship between User Agency and User Experience in IN systems?

Q2 and its sub-questions will be answered by the developed framework, which was built based on findings from section2.2 and section2.3. To answer Q3, a case study was first conducted to evaluate and redesign the design of user agency of a chosen IN system. And then, the redesigned version was compared with the original version of the IN system in an experiment. The experiment will be used to collect quantitative data to measure whether the guide of the developed frame can provide a better user agency and whether a better user agency will result in better user experience. This chapter will first describe the development of the user agency design framework, second the case study and third the experiment design, hypotheses and data collection.

3.1 Development the Framework of Designing User Agency in IN

The framework of designing user agency consists of two parts. The first part is to answer Q2.1 what aspects should be considered when designing the User Agency. The second part is to answer Q2.2 how to design the user agency in the context of IN, which consists of different approaches mapped in the user-centered design process.

3.1.1 Key aspects of designing User Agency

The first part of the framework (Figure 7) consists of 3 aspects need to be considered when designing user agency: Clear Intention, Fluent Action Selection, and Consistent Outcome Comparison. As discussed in section2.1 and section2.2, intention, action selection and outcome comparison are 3 essential phases of producing a sense of agency and a clear intention, a fluent action selection process and a consistent outcome comparison contribute to a better user agency.

3.1.2 Approaches of designing User Agency

The second part of the framework consists different approaches summarized from section2.2 and section2.3. These approaches were mapped in the user-centered design process.



Figure 7: Framework Part 1: 3 essential aspects should be considered when designing User Agency

User-centered Design Process

According to Baxter et al. [31], the user-centered design process is divided into 4 stages: Concept, Design, Develop, Release. The first stage of the user-centered design process is to identify user profile and conceptualize the product. The second stage is to prototype, evaluate, iterate the design of the product. The third stage is to implement the product. And the last stage is to release the product to users. Approaches summarized from literature reviews were mapped from stage 1 to 3. Stage 4 release was excluded because it focuses more on the release of a finished product.

Stage 1: Concept

- User research on users and interaction
 - This approach is aimed to investigate and understand what kind of interactions users are familiar with. Using interactions which already existed in users' mental model can increase their capability and confidence when interacting with the system and therefore make the action selection process more fluent.
- User research on users and expected outcomes
 - This approach is to investigate and understand users' expected outcomes of interactions in the IN systems. The outcomes consist of 2 different types: local effectance and global effectance. In IN, effectance is referred to as the effect a chosen action has. Local effectance means immediate effects of player's actions and decisions, such as visual or sound feedback, change of character statistics, etc. Global effectance means the long-term effects of the story line made by players' actions and decisions [27]. For example, the story will alter in different ways depends on users' actions. This research helps to match actual outcomes of interactions in IN systems and users' expected outcomes.

Stage 2: Design

- Use story plot to provide intentions
 - When designing IN systems, the story plot can be used to provide users with a clear intention. The plot clarifies users' tasks, goals when they experience the IN system and so

that the users know which actions they should take. On the other hands, when evaluating the design of IN systems, designers should evaluate whether users get a clear intention from the story plot.

- Use material affordances to assist users
 - Material affordances in IN like other characters' languages, actions, objects in the environment, user interface can be used to suggest and imply users what actions to do, how to conduct them and what outcomes to expect when designing the IN systems, which will facilitate both a smoother action selection process and a consistent outcome comparison process. For evaluation, designers should check whether these material affordances provide enough facilitation for users' experience.
- Build links between interactions and outcomes
 - When designing the IN systems, designers can build links between interactions and outcomes by providing a temporal association, a shared meaning connection or a predictive connection. By doing so, users can learn what outcomes to expect when encounter interactions they are not familiar with.
- Provide feedback mechanics
 - The feedback mechanisms provide the external standards for corrective adjustments. Providing appropriate feedback when design the IN system can help users adjust their actions and eventually achieve an outcome close to the predicted outcome.

3.1.3 Stage 3: Develop

- Develop consistent computer model
 - A consistent computer model ensures rules of interaction in IN systems are consistent. Therefore, it's easier for users to learn how to perform the action, feel more confident to perform the action, know what to expect when performing the actions and helps the player build links between actions and outcomes after they get familiar with the system.

Figure 8 shows part 2 of the framework. The design process starts from stage 1 concept and ends at stage 4 release. It is an iterative process which means it can go back to a previous stage iterate the design during the process. Different approaches are mapped beside stage 1-3. The icons after each approach denote which essential aspects of designing user agency it contributes to. The yellow icon denotes that this approach contributes a clear intention. The green one denotes it contributes a smoother action selection. The blue one denotes it contributes a consistence outcome comparison.

The framework can be used both to evaluate and design the user agency of an IN system. In the next section, the researcher demonstrated how to use the framework in a case study.

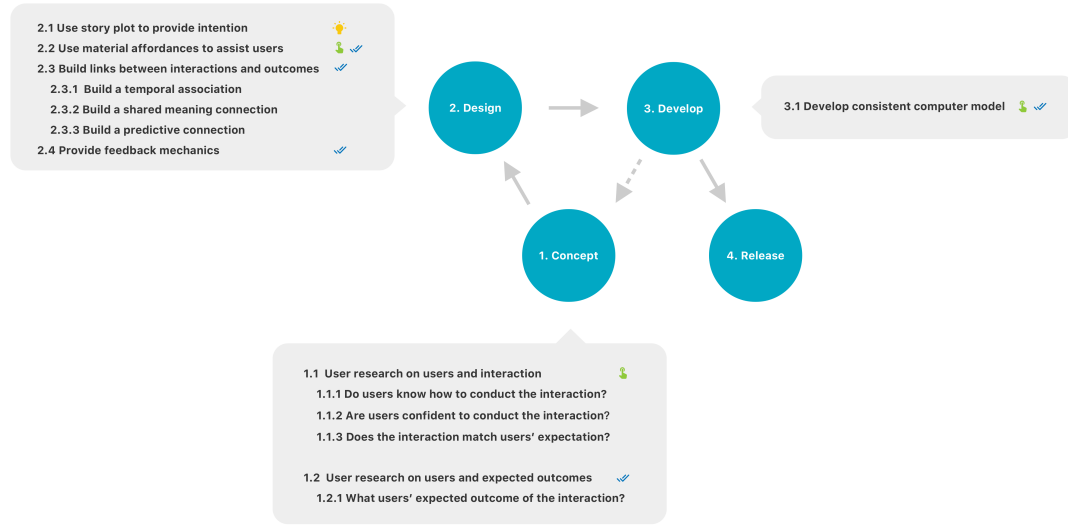


Figure 8: Framework Part 2: Approaches of designing User Agency

3.2 Case Study: Evaluate and improve the User Agency of a dialogue-based chat game

3.2.1 Choice of the IN system

A mobile dialogue-based text game Lifeline [32] was chosen to be evaluated and redesigned in the case study. In the game, the player guides the protagonist, Taylor, to survive an unknown moon after his spaceship crashed, by choosing which dialogue to respond to Taylor. The story plot will be altered depends on the dialogue players has chosen.

The game was chosen for 2 reasons. Firstly, the interaction in the game, choosing responses in a conversation with other characters, is very common in different forms of IN systems. Therefore, the result of testing on this interaction can be generalized to other IN systems. Figure 9 shows some examples of how different IN systems involve choices in them.

The second reason is considering the feasibility of conducting the experiment. As Lifeline is a text-based mobile game, the system is relatively simple. Therefore, redesigning and prototyping the system is more feasible in the research. For participants of the experiment, the threshold of using the system is also lower, as most of them are more familiar with a mobile platform and chat applications than other game platforms.

The chosen of the IN system to provide as an example to apply and test the framework. The framework can, however, be used to design user agency for any IN systems.

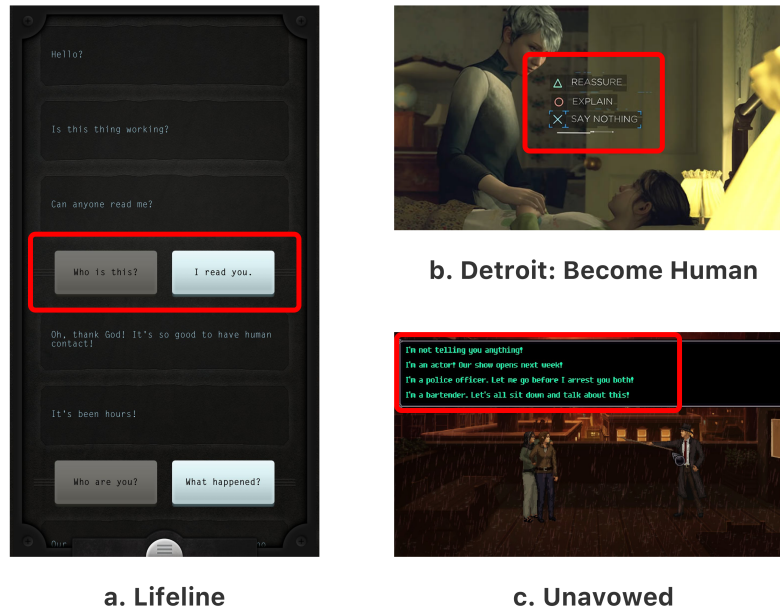


Figure 9: Examples of IN systems with the choice-based interaction: a. Lifeline [32], b. Detroit: Become Human [33], c. Unavowed [34]

3.2.2 Process of Evaluation

The evaluation process consists of 2 parts. Participants firstly had a user test of the selected IN system Lifeline. After they experienced the system, a post-test interview was conducted to collect their feedback about the system. Qualitative data was collected to whether users have a clear intention, a smooth action selection process and a consistent outcome comparison process during the experience of the selected IN system. The data was later used to redesign the system.

User Test

8 users, 4 males and 4 females, in the ages of 24 to 30, were recruited to participate in the user test. All participants have been pre-screened to make sure they have experience of playing mobile games. None of them had played Lifeline before. 5 of the participants works full time and the other 3 were students and/or part-time workers at the time of the user test.

All user tests were conducted on researchers mobile phone. After each participant finished the test, the game was rewound to the beginning of the story to make sure every participant starts the game from the same point. Participants were asked to freely experience the game for 5 minutes. Due to different options, participants had chosen, the story line may progress differently at the end of the user test. During the user test, participants' behaviours were observed by the researchers to

note down their notable reactions and problems they met.

Interview

After each participant finished the user test, an interview was followed up. The interview guide prepared were semi-structured and questions asked in the interview were made based on the built framework. The aim of these interviews is to collect participants' feedback on the experience of play the IN system Lifeline. The interview guide consists of three parts. The first part is to investigate did participants have a clear intention throughout the experience and, if not, what are the problems. The second part is to investigate did participants select the action smoothly during the experience and, if not, what are the problems. The third part is to investigate did participants have a consistent outcome comparison during the experience and, if not, what are the problems. The interview guide can be found in [Appendix B](#).

Results

The collected qualitative data was summarized in 3 categories: Intention, Action selection, Outcome Comparison.

- Part 1: Intention
 - 5 out of 8 participants thought they didn't have a clear goal during the experience.
 - 4 out of 8 participants felt there was too much random talk during the conversation which made it harder to get the goal and Taylor's situation.
 - All participants felt Taylor sent too many messages at once which made them impatient to finish reading before making the selection
 - 3 out of 8 participants didn't feel like to help Taylor because he sometimes was too annoying.
- Part 2: Action Selection
 - 7 out of 8 participants thought it is easy to select an option in the game because the interface is intuitive.
 - 1 participant felt a bit confused when select options for the first time because the interface is different from other systems. But after tried once, the participant learned how to select options.
 - 6 out of 8 participants thought it's not so easy to make a selection when the provided options are too similar.
 - 5 out of 8 participants didn't feel confident to make the decision when options don't have a clear tendency.
 - 5 out of 8 participants felt a couple of the options were not what they would like to do in either case, but it didn't annoy them too much. In these cases, they usually spent more time to make the choices.
 - 6 out of 8 participants would anticipate the outcome of each option and then select the one match their intention. But sometimes, neither of the options match their intention.

The actual outcome of the option sometimes matched their expectation.

- 6 out of 8 participants made their choices based on Taylor's needs and the responsibility of the role they are playing. They felt it's their responsibility to help Taylor.
- 3 out of 8 participants could feel the author was suggesting them to select certain options by the conversation with Taylor. They felt it's fun and perceived a sense of achievement when they notice these small hints in the conversation.

- Part 3: Outcome Comparison

- 6 out of 8 participants thought after they selected an option, the option would be displayed like a sent-out message, instead of just a selected option, but it didn't annoy them too much as they clearly know it is a game, not real-time communication.
- 5 out of 8 participants thought they didn't get enough feedback and it's difficult to know whether the story progressed as they expected.
- 6 out of 8 participants felt outcomes of options with a clear tendency mostly matched their expectation. While it's difficult to anticipate the outcomes of options without a clear tendency.
- 3 out of 8 participants had the feeling of "I've chosen the correct option".
- 3 out of 8 participants could feel they were implied what will happen after selecting an option. They perceived a sense of achievement when they notice these implications. However, some participants thought it reduced the fun of surprise when the implications are too obvious.
- 6 out of 8 participants thought the interaction in the game is consistent.

To summary, in terms of Part 1: Intention, there are 2 main problems. The first one (P1.1) is that there are too many side stories and jokes which distract users and make it difficult for users to get the intention. The second one (P1.2) is that the protagonists often sends many messages at one time, which annoyed and overwhelmed users. These 2 problems obstructed users from getting intention from the story.

In Part 2: Action Selection, there are also 2 main problems. The first one (P2.1) is that it's more difficult for users to make a choice when the provided options were ambiguous or without a clear tendency. In these cases, users didn't know what outcomes to expect after selecting the option and didn't feel confident when they make the choice. The second problem (P2.2) is the lack of assistance from the material affordances. The interface of Lifeline is intuitive and well-suggested on how to conduct the interaction. However, users felt that implications in conversations were not enough, which sometimes made them didn't know what outcomes to expect after selecting the option and didn't feel confident when they make the choice. These 2 problems made the action selection process less smooth during the experience.

There are 3 main problems in Part 3: Outcome comparison. The first problem (P3.1) is that users felt there are not enough feedback after an option was selected and they didn't know whether the story progressed as they expected. The second problem (P3.2) is that users didn't know what to

expect when facing those choices which were ambiguous and did not make a difference in the story. The third problem (P3.3) is that the lack of assistance from the material affordances. There were not enough implications in conversations to suggest what to expect of each option. These 4 problems made the outcome comparison process less consistent.

3.2.3 Redesign and prototype

The redesigned version of Lifeline covers the content of the introduction part of the whole story, which takes about 5 minutes to finish exploring. There are about 10 20 choices users can make, depends on which branch the story goes. The branch chart of the selected part of the story line can be seen in AppendixC. The redesign was mostly about the interface and the way to present the story. The main plot of the game was not changed.

4 solutions were proposed in regard to 8 problems summarized in the previous section. These solutions are as follows.

Solution 1: Delete less relevant side stories

This solution is to solve the problem P1.1. Less relevant side stories were deleted in the redesigned version of to make users focus more on the main story and help them get an intention from the story more easily. This solution also helps to solve P1.2, as less random side stories can make Taylor less chatty and annoying.

Figure 10 shows an example of reduced side stories in the redesigned version.

Solution 2: Load the message manually

This solution is to solve the problem P1.2. In the redesigned version, the messages are loaded by users themselves. By doing so, the users can read the messages on their own pace instead of being overwhelmed by too many messages at one time. At the start of the game, there will be a system message claims that users have to load messages manually due to the unstable single, which provides a reasonable context of the interaction and is used as a tutorial to help users build the connection between the interaction and the feedback after the interaction.

Moreover, when users conduct the interaction of loading a message, they have an intention to get a new message; they can easily select the action by clicking the screen, and the loaded new message matches their expected outcomes. Therefore, users hypothetically can also generate a sense of user agency by conducting this interaction.

Figure 11 shows how to load a message in the redesigned version.

Solution 3: Add local effectance on ambiguous options

This solution is to solve the problem P2.1, P3.1 and P3.2. Suspense and surprise are 2 important aspects in a good story and due to this nature, sometimes it can be hard to anticipate how will users' decisions affect the story line (the global effectance). A solution to let users have something to expect without spoil the story is to add local effectance on the interaction. In the redesigned version, additional attributions were added on each option depend on its tendency. If an option is more rational, then after users select this option, they will get 1 point of "Logic". If an option is more sensitive, then after users select this option, they will get 1 point of "Empathy". Those points can

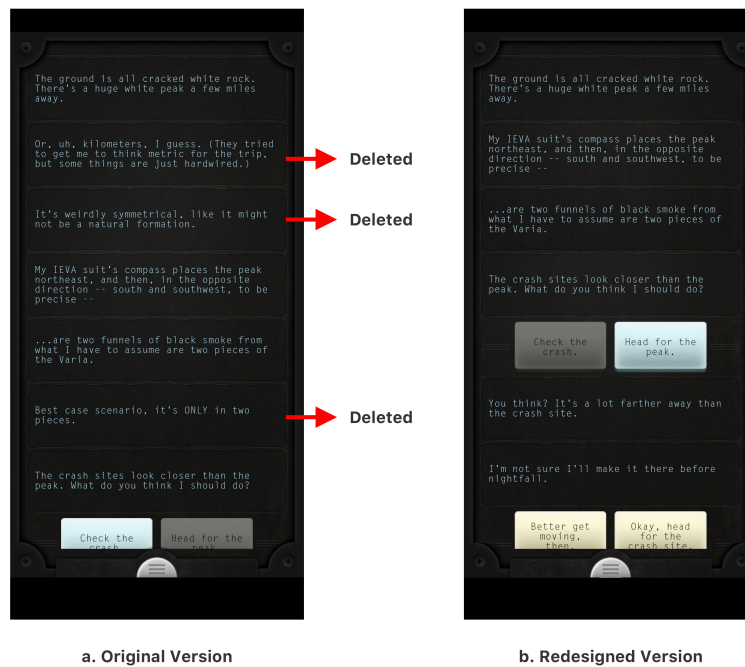


Figure 10: Solution 1: Delete less relevant side stories – a. Original version, b. Redesigned version with fewer side stories.

be further used in the game, for example, to unlock some special endings, which are not included in this research. The local effectance makes it easier for users to build expectation when the global effectance is not obvious, which helps users make decisions. Moreover, the visual feedback of add points after selecting an option clearly tells whether the outcomes match users' expectation, which facilitates the outcome comparison process.

Figure 12 shows an example of visual feedback after selecting an option in the redesigned version.

Solution 4: Highlight keywords

This solution is to solve the problem P2.2 and P3.3. Material affordances are an important part to imply users what outcomes to expect. With an expected outcome, users know which action to select and can compare it with the actual outcome. In the game Lifeline, the main affordances are Taylor's dialogues. So it is important to provide more implications in the dialogues to help users build expectations. In the redesigned version, some keywords which imply users what to expect were modified and highlighted to make them more obvious for users. The modifications of the dialogue were minor and did not chat any plots.

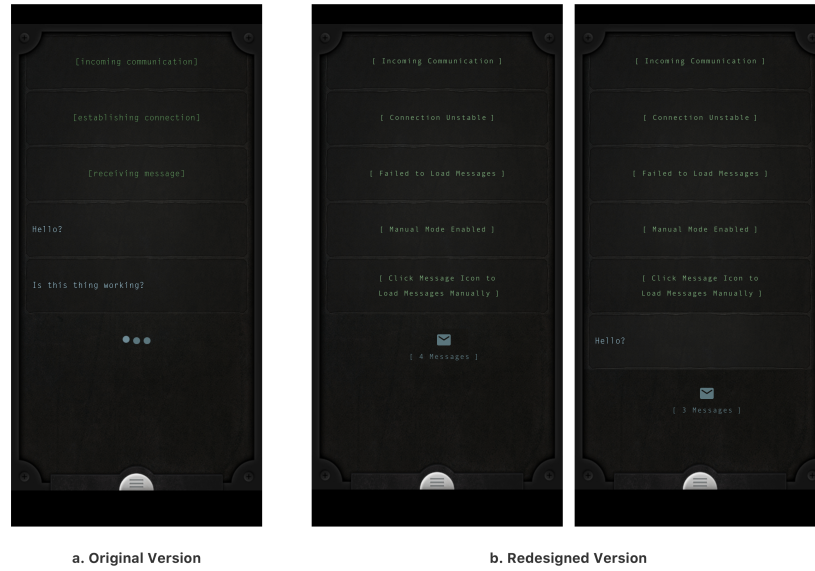


Figure 11: Solution 2: Load the message manually – a. Messages are loaded automatically in the original version, b. Messages are loaded manually in the redesigned version. Several system messages are provided to guide users.

Figure 13 shows an example of highlighted keywords before selecting an option in the redesigned version.

Prototype

The prototype of the redesigned version was created by the software Sketch [35]. The function Sketch Mirror [36] was used to display the prototype on the mobile phone to make the play experience more similar to the original version.

3.3 Experiment Design

There are two objectives to this experiment. The first one is to evaluate whether users will perceive a higher sense of user agency in an IN system which is designed based on the built framework. The second goal is to answer the research question Q3: What's the relationship between User Agency and User Experience in IN systems?

The experiment consists of 2 evaluations, 1 for the original version of Lifeline and 1 for the redesigned version of Lifeline. Each evaluation consists of two sessions. In the first session, participants will interact with the given version of Lifeline. This session will take around 5-10 minutes. Upon completion, an evaluation survey will be administered for participants to assess the user agency and user experience of the given version of Lifeline. The second session will take around



Figure 12: Solution 3: Add local effectance on ambiguous options – Users will get different points depends on which option they select; total points can be checked in menu.

10-15 minutes. After the first evaluation was completed. Participants will have a 5-minutes break. Then the evaluation of another version of Lifeline starts, with the same two sessions. The whole experiment will take about 40-60 minutes.

For the survey, an adapted version of Roth's scale, which is mentioned in sector 2.4, is used in the survey to evaluate the user experience and user agency of the IN system. The scale was previously validated [27] and has been previously used to evaluate the user experience of IN systems [37]. The survey can be seen in Appendix A.

All participants will be divided into 2 groups. Participants in group A will evaluate the original version of Lifeline first while participants in group B will evaluate the redesigned version of Lifeline first. Participants will not be told which version they are interacting with during the experiment.

Table 1 shows the process of the experiment for Group A and Group B.

Experiment Design				
Group A	original version	Session 1: Interact with the prototype Session 2: Survey	redesigned version	Session 1: Interact with the prototype Session 2: Survey
Group B	redesigned version	Session 1: Interact with the prototype Session 2: Survey	original version	Session 1: Interact with the prototype Session 2: Survey

Table 1: Experiment Design: the process of the experiment for Group A and Group B



Figure 13: Solution 4: Highlight keywords – Keywords which will influence the story line are highlighted to make implications in material affordances more obvious

3.3.1 Independent variable and Dependent variable

The independent variable and dependent variable are shown as follows:

- Independent variable
 - Original version of Lifeline (Without the guide of the built framework)
 - Redesigned version of Lifeline (With the guide of the built framework)
- Dependent variable
 - User Agency
 - User Experience

3.3.2 Hypothesis

There are two Hypotheses in this experiment, which are shown as follows:

- H_11 Participants will perceive higher user agency in the redesigned version of Lifeline.
- H_12 User Agency and User Experience will have a positive linear relationship.

3.4 Data Analysis

The survey contains 47 questions used to measure the user experience of IN systems. Each question is a 5-point Likert scale from “strongly disagree” to “strongly agree”. The point of most questions will be added together. 6 out of these 47 questions are negatively framed in the survey, therefore, the points of these questions will be deducted instead of being added in the total points. The final result of the total points is referred to as UX(User Experience) score.

Among these 47 questions, 11 questions are used to measure the user agency of IN systems (questions under aspects of Usability, Effectance and Autonomy). Similarly, the point will be added together, except 1 negatively framed question, whose points will be deducted in the total points. The final result of the total points is referred to as UA(User Agency) score.

The UX score and UA score of the original and redesigned version of Lifeline will be compared using a paired-samples t-test to find out whether there is a significant difference of user agency and user experience between these two versions.

To investigate the relationship of user agency and user experience, a bivariate Pearson Correlation will also be conducted to find out whether there is a linear relationship between the UX score and UA score.

3.5 Experiment Setup

8 participants were recruited through convenience sampling, within the age group of 23-34. 5 participants were male while the other 3 are female. None of the 8 participants had participated in the earlier interviews. The participants were invited to test 2 versions of a game, which means they were not aware that the goal of the experiment is to evaluate the user agency and user experience of IN system and the relationship between these 2 factors. Participants were neither told which one version was the original or redesigned one to prevent they have prejudgments. Participants were assigned to Group A and Group B in order. The first participant was assigned to Group A, the next one was assigned to Group B, and the process repeated.

Before the participants began the experiment, they were given a written consent, which can be seen in AppendixD. Then participants of Group A started to interact with the original version on the researcher’s mobile phone. Upon completion, they were given the Survey OA (original version, group A) on the researcher’s laptop. After a 5 minutes break, participants started to interact with the redesigned version on researcher’s mobile phone. And then they were given the Survey RA (redesigned version, group A) on the researcher’s laptop. The process for participants in Group B is the same except the order of the given version. They were given the Survey RB (redesigned version, group B) and Survey OB (original version, group B). The different surveys were used to

store different data for analysis, the content is all the same.

4 Results

This chapter will present the results of data analysis of the experiment. The data was analyzed using SPSS.

4.1 Overall scores

In this section, the UX score and UA score of the 2 versions of Lifeline will be shown. In addition, the score of each individual dimension of user experience of IN will also be showed. As mentioned in sector 2.4, these dimensions include usability, effectance, autonomy, flow, presence, character believability, identification, aesthetic pleasantness, curiosity, suspense, satisfaction of expectations, positive and negative affect, enjoyment. The score of each dimension was re-scaled to values between 0 and 1 for easier comparison, using the following formula. All data were rounded to 2 decimal places.

$$X_{new} = \frac{x - X_{min}}{X_{max} - X_{min}}$$

Table 2 shows the overall scores of the 2 versions of Lifeline.

Scores	Original Version			Redesigned Version		
	Original (All)	Original (A)	Original (B)	Redesigned (All)	Redesigned (A)	Redesigned (B)
UX	0.30	0.31	0.29	0.36	0.37	0.36
UA	0.41	0.45	0.38	0.47	0.46	0.48
Usability	0.82	0.88	0.77	0.86	0.81	0.92
Effectance	0.33	0.33	0.33	0.46	0.48	0.44
Autonomy	0.24	0.29	0.19	0.24	0.23	0.25
Flow	0.37	0.41	0.33	0.57	0.50	0.64
Presence	0.27	0.27	0.27	0.17	0.27	0.06
Character believability	0.28	0.31	0.25	0.42	0.31	0.53
Identification	0.19	0.13	0.25	0.18	0.25	0.10
Aesthetic pleasantness	0.18	0.06	0.29	0.18	0.31	0.04
Curiosity	0.45	0.52	0.38	0.48	0.56	0.40
Suspense	0.34	0.36	0.31	0.34	0.34	0.33
Satisfaction of expectations	0.19	0.15	0.23	0.26	0.27	0.25
Positive and negative affect	0.21	0.22	0.21	0.32	0.30	0.34
Enjoyment	0.27	0.38	0.16	0.33	0.25	0.41

Table 2: Overall scores of the 2 versions of Lifeline

4.2 Comparison of UA score in 2 versions of Lifeline

The UA (User Agency) score was calculated by the points of 11 5-point Likert scale questions used to measure the user agency of IN. The data-set was analyzed by running a paired-samples t-test.

The analysis performed on this data set was used to test H_1 1 Participants will perceive higher user agency in the redesigned version of Lifeline. The descriptive statistics of the characteristics data analysis can be found in Table 3 and Table 4.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Original	25.8750	8	3.27054	1.15631
	Redesigned	28.5000	8	3.29502	1.16496

Table 3: Paired Samples T-test of UA score 1

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Original - Redesigned	-2.62500	2.66927	0.94373	-4.85657	-0.39343	-2.782	7	0.027

Table 4: Paired Samples T-test of UA score 2

The paired-samples t-test found that there is a significant difference ($P < .05$) between the UA score of the 2 versions of Lifeline. The mean UA score of the redesigned version of Lifeline ($M = 28.5000$, $SD = 3.29502$) is higher than the mean UA score of the original version of Lifeline ($M = 25.8750$, $SD = 3.27054$).

The results suggest that participants perceived a higher sense of user agency from the redesigned version of Lifeline than from the original one.

4.3 Comparison of UX score in 2 versions of Lifeline

The UX (User Experience) score was calculated by the points of 47 5-point Likert scale questions used to measure the user experience of IN. The data-set was analyzed by running a paired-samples t-test. The descriptive statistics of the characteristics data analysis can be found in Table 5 and Table 6.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Original	80.2500	8	13.18820	4.66273
	Redesigned	93.8750	8	13.38909	4.73376

Table 5: Paired Samples T-test of UX score 1

The paired-samples t-test found that there is a significant difference ($P < .05$) between the UX score of the 2 versions of Lifeline. The mean UX score of the redesigned version of Lifeline ($M = 93.8740$, $SD = 13.38909$) is higher than the mean UA score of the original version of Lifeline ($M = 80.2500$, $SD = 13.18820$).

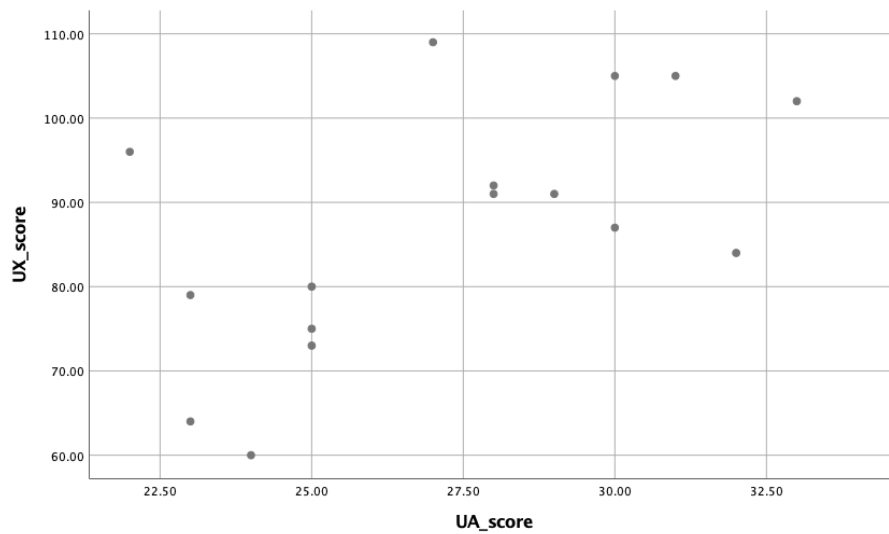


Figure 14: Scatter plot shows the correlation between user agency and user experience

- User Agency and Flow
 - The Pearson correlation found that there is a significant correlation ($P < .01$) between the user agency and flow. The correlation is strongly positive ($r = 0.717$).
- User Agency and Effeteness
 - The Pearson correlation found that there is a significant correlation ($P < .01$) between the user agency and flow. The correlation is strongly positive ($r = 0.687$).

4.5.2 Moderate Positive Correlation

- User Agency and Character Believability
 - The Pearson correlation found that there is a significant correlation ($P < .05$) between the user agency and character believability. The correlation is strongly positive ($r = 0.523$).
- User Agency and Postive and Negative Affect
 - The Pearson correlation found that there is a significant correlation ($P < .05$) between the user agency and positive and negative affect. The correlation is strongly positive ($r = 0.516$).

4.5.3 Not Significant Correlation

The Pearson correlation found that there is not a significant correlation between the user agency and Usability, Presence, Identification, Aesthetic Pleasantness, Curiosity, Suspense, Satisfaction of Expectations and Enjoyment.

5 Discussion

This chapter will first discuss the implementation of the framework of designing user agency. Then the discussion will move to the results of the experiment. After that, discussions about the contributions and limitations of this research will be followed up.

5.1 The implementation of the framework

The second research question in this research is Q2: How can we design the user agency in an interactive narrative and the sub-questions concerns what aspects should be considered when designing the user agency, and how to design the user agency in the context of interactive narrative. Through the literature review of related works and theories, the researcher found that aspects should be considered when designing the user agency are as follows:

- A clear intention
- A smooth action selection process
- A consist outcome comparison process

The researchers further investigated and summarized different approaches which can be used to contribute to these 3 aspects. These approaches were mapped into the user-centered design process.

The framework can be used both in the user research and design stage. In the user research stage, it narrows down the most important feedback designers need to collect from users when designing the user agency, which helps to create questions for an interview, survey, focus group or other user involved research activities. In the design stage, the frameworks provide approaches of helping users build intention, designing interfaces which can increase users' capability and confidence to conduct the interaction, build links between interactions and outcome. It also helps to narrow down the most important aspects which need to be checked when evaluating the design.

The framework is still at an early edge and can be iterated to involve more approaches and fit more different situations.

5.2 Overall Scores

The overall scores show some limitations of the experiment. As shown in Table 2, the score of presence, character believability, identification, aesthetic pleasantness, satisfaction of expectation, positive and negative affect were very low. They might be caused by the short story line participants went through during the experiment.

The build of presence, character believability, identification, aesthetic pleasantness and emotional resonance takes time and requires the audience to immerse themselves and feel the growth of the character. However, in the experiment, participants have only gone through the introduction

part of the story, it's hard for them to build these feelings in such a short time. The general low score in these aspects for both versions of Lifeline makes it difficult to tell whether the redesigned version caused a difference in the performance of these aspects.

5.3 Comparison of UA score in 2 versions of Lifeline

The result of the comparison of UA score in 2 versions of Lifeline suggests that participants perceived a higher sense of user agency from the redesigned version of Lifeline than from the original one, which supports the H_1 1 Participants will perceive higher user agency in the redesigned version of Lifeline.

This result suggests that the Lifeline redesigned based on the built framework to provide a better user agency for the users. It validates that the framework of designing user agency in IN can answer the second research question Q2: How can we design the user agency in interactive narrative?.

The result from section 4.5 shows that there is a significant positive correlation between user agency and effectance and autonomy, but there is no significant correlation between user agency and usability. Considering that the score of the user agency is the sum score of usability, effectance and autonomy, this result suggests participants perceived higher user agency mostly because they perceived a higher effectance and autonomy.

This may due to the redesign of the Lifeline focused on providing more local effectance in the game. With more local effectance, participants had something to expect and had more feedback to check if the outcome matches their expectations, and therefore they perceived a higher sense of autonomy.

The reason why there is not a significant relationship between user agency and usability may due to the simple interaction in both versions of the Lifeline. As shown in Table 2, the score of usability of both versions of Lifeline was relatively high compared with other scores. This is because the interaction in the game is very simple, and most participants thought it was easy to learn and use for both versions. Therefore, the difference in usability is not obvious and the correlation between user agency and usability is not significant.

5.4 Relationship between User Agency and User Experience

The Pearson correlation suggests that there is a significant correlation between the user agency and user experience. The correlation is moderately positive. The result supports the H_1 2 User Agency and User Experience will have a positive linear relationship and answered the third research question Q3: What's the relationship between User Agency and User Experience in IN systems?. The result is not a big surprise, as the user agency itself is considered as an important part of the user experience of user experience. However, the result found that the positive linear relationship is not perfect, which mean a higher user agency will not always cause a better user experience.

The result of the relationship between user agency and other individual dimensions of user experience gave a further explanation of the relationship between user agency and user experience. It shows that the user agency has positive linear correlation with Flow, Character Believability and Positive and Negative Affect. However, user agency has no significant correlation with other

dimensions of user experience. Though the correlation is not significant, the user agency showed a slightly negative correlation with Suspension ($r=-.011$) and Aesthetic Pleasantness. One reason that the negative correlation is not significant might be that participants only experienced a short part of the story in Lifeline in the experiment if they spend more time and immerse them in the story, the negative correlation might be more significant.

This suggests a better user agency can only positively affect a part of dimensions of user experience in IN. Some approaches of improving user agency may decrease the perception of other dimensions. For example, if there are too many implications in material affordances, it may help users to build intention and know what to expect, but it also may destroy the fun of suspense and curiosity during experiencing the story.

5.5 Contributions

In the Introduction of the report, it was stated that the planned contributions would consist a clear definition of the concept of user agency, a framework contains key aspects and design approaches of designing user agency in IN systems, and the relationship between user agency and user experience in IN.

The definition of the concept of user agency has been defined in detail in the related work section as a satisfying power to be able to conduct the desired actions and cause the expected consequence for a certain intention.

The framework of designing the user agency in IN systems has been laid out in the methodology section, which can be used, modified and iterated by other designers and researchers. However, the framework might be more suitable for designing IN systems similar to Lifeline, which involves simply interactions, because the framework was only validated with the IN system Lifeline.

The relationship between user agency and user experience in IN has been explained in the result section, which is a moderate positive linear correlation. Again, the relationship might be more suitable for IN systems similar to Lifeline.

5.6 Limitations of the Research

In this section, the limitations of the research will be discussed.

5.6.1 Sample Size and Participants Recruitment

There are 8 participants in the experiment, which is not a very large sample size. This might affect the reliability of the experiment results.

All participants were recruited by convenience sampling, which means all participants were acquainted with the researchers. This familiarity could have affected the results to some degree.

5.6.2 External Validity of the Research

Due to the time constraints, the built framework was only validated in a certain type of IN system, which involves relatively simple interactions. And in the experiment, participants only experienced a short part of the story line. Therefore, the results might be more suitable for IN systems with light

interactions and short story lines. This might cause a low external validity of the research and it might be difficult to generalize the result to other types of IN systems.

5.6.3 Experiment Design

In the experiment, all participants were divided into 2 groups, and the order of 2 rounds of the evaluation was reversed. This setting was used to avoid the learning effect. There were effects of the different order observed during the experiment. For example, a few participants wanted to go back and change their answers from the first round of evaluation as they felt they were too nice or too strict in the first round. However, due to time constraints, the effect of changing the order was not considered when analyzing the results.

6 Conclusion

This thesis is intended to contribute a better user experience in IN systems from the perspective of user agency. It aims to have a deepened account of the concept of user agency, to investigate how to design the user agency, and to have a better understanding of the relationship between user agency and user experience.

The research questions and sub-questions to be addressed in the research project are shown as follow. All the research questions were answered in the thesis.

- Q1: How to define User Agency?
- Q2: How can we design the User Agency in Interactive Narrative?
 - Q2.1: What aspects should be considered when designing the User Agency?
 - Q2.2: How to design the User Agency in the context of Interactive Narrative?
- Q3: What's the relationship between User Agency and User Experience in IN systems?
 - Q3.1: What aspects should be considered when evaluating the user agency in the Interactive Narrative Systems?
 - Q3.2: What aspects should be considered when evaluating the user experience in the Interactive Narrative Systems?

The first research question Q1: How to define User Agency was answered by summarizing Moore's definition of sense of agency, Chambon et al's computational motor control framework of sense of agency, Murray and Church's definitions of player agency in section 2.1.3, and it was defined as:

A satisfying power to be able to conduct the desired actions and cause the expected consequence for a certain intention.

The second question Q2: How can we design the User Agency in Interactive Narrative was answered by the implementation of a framework of design user agency in IN systems in section 3.1. The framework summarized that there are 3 key aspects need to be considered when designing user agency in IN systems: 1) Intention, 2) Action Selection, 3) Outcome Comparison. It maps approaches of designing user agency in the user-centered design process. In the stage of concept, user researches on users and interactions, which helps to design the interaction which users are able to and confident to conduct. This will contribute to a smoother action selection process. Researches on users and expected outcomes should be conducted, to design outcomes which match users' expectations. This will contribute to a more consistent outcome comparison process. In the stage of design, the framework suggests to use the plot of the story to provide intentions to users; to use material affordances to suggests users how to perform interactions, what outcomes to expect,

etc.; to build links between interactions and outcomes to help users learn what outcomes to expect; to provide feedback mechanics to help users successfully performing the action and give them a clearer idea whether they achieve the expected outcomes. In the stage of develop, the framework suggests developing a consistent computer model underline the IN system, which helps users build links between actions and outcomes and learn how to perform interactions and what outcomes to expect after performing an interaction.

The framework was validated in the experiment, as the statistic data in section 4.2 shows that the user agency of the IN system redesigned based on the framework was significantly better than the original one without the guidance of the framework.

The subquestion Q3.1: What aspects should be considered when evaluating the user agency in the Interactive Narrative Systems and Q3.2: What aspects should be considered when evaluating the user experience in the Interactive Narrative Systems were answered in section 2.4. There are 14 dimensions when evaluating the user experience in IN, they are: Usability, Effectance, Autonomy, Flow, Presence. Character believability, Identification, Aesthetic pleasantness, Curiosity, Suspense, Satisfaction of expectations, Positive and negative affect, and Enjoyment. Among these 14 dimensions, 3 dimensions are used to evaluate the user agency of IN systems. They are Usability, Effectance, and Autonomy.

The third research question Q3 what's the relationship between User Agency and User Experience in IN systems was answered in section 4.4 and section 4.5. The statistic data shows that there is a moderate positive correlation between user agency and user experience. In details, user agency has a strong positive correlation with Effectance, Autonomy, and Flow, and a moderate correlation with Character Believability, Positive and Negative Affect.

6.1 Future Research

For future research, it is recommended to test the relationship between user agency and user experience in different types of IN. There are many different types of IN systems exist with various emphases. Some focus more on the narrative, some focus more on the interactions, some are used for entertainment, some are used for education, etc. The understanding of the relationship between user agency and user experience in various context can strongly complement the framework of designing user agency and can help benefit the user experience of IN systems.

Another aspect of future research is to investigate approaches of using story to provide global effectances. In this research, summarized approaches focused on providing local effectances with material affordances like the interface and the way of interaction. How to provide global effectance with formal affordance (the story plot) remains underdeveloped. This research will be more under the domain of Narratology. The understanding of the use of formal affordance will further improve the framework of designing user agency and can also help benefit the user experience of IN systems.

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A 5-point Likert scale used to evaluate the User Experience of IN systems

N” denotes negatively framed items that needs to be recoded when analyzing the data. “R” denotes items which are adapted by the researcher.

Usability:

1. I thought the system was easy to use
2. I would imagine that most people would learn to use this system very quickly
3. I know how to select from different options in the system (R)

Effectance:

1. My inputs had considerable impact on the events in the story
2. I had the feeling that I could directly affect something on the screen
3. My decisions clearly influenced how the story went on
4. My inputs had impact on the events in the story in a way I expected (R)

Autonomy:

1. I had the impression that I was able to make many different events happen in the story
2. I noticed many opportunities to influence the story
3. I felt strong limitations to my decisions how the story should proceed (N)
4. The system gave me precisely those options to influence the storyline that I had in mind

Flow:

During the experience,

1. I felt competent enough to meet the demands of the situation
2. I acted spontaneously and automatically without having to think
3. I had a strong sense of what I wanted to do
4. I had a good idea while I was performing about how well I was doing
5. I was completely focused on the task at hand

Presence:

1. I felt like I was a part of the presented environment
2. I felt like I was actually there in the presented environment
3. It seemed as though I actually took part in the action of the presentation

Character believability:

1. I could feel what the characters in the environment were going through
2. I had the impression that the characters in the environment responded in a thoughtful way to

what I did

Identification:

1. I felt like as was in the main character's skin
2. I sometimes forgot about myself because I was so focused on the actions of the main character
3. I felt more like the character than like myself

Aesthetic pleasantness:

1. The experience told me something about life
2. The experience was inspiring
3. The experience moved me like a piece of art

Curiosity:

1. During the experience, I felt curious
2. During the experience, I felt interested
3. During the experience, I felt inquisitive

Suspense:

1. At some moments I was anxious to find out what would happen next
2. Sometimes I was worried about how the story would develop
3. Some moments were rather suspenseful
4. I found myself wishing for a particular story outcome

Satisfaction of expectations:

1. The experience was better than I expected
2. I expected the experience to be more enjoyable (N)

Positive and negative affect:

How do you feel at this moment, after experiencing the story?

1. Excited
2. Powerful
3. Enthusiastic
4. Sad (N)
5. Annoyed (N)
6. Anxious (N)
7. Tough
8. Proud
9. Troubled (N)

Enjoyment:

The experience was

1. entertaining
2. enjoyable

B Semi-structured interview guide

B.1 Interview Objective

The aim of these interviews is to collect participants' feedback on the experience of play the IN system Lifeline. The interview guide consists of three parts. The first part is to investigate did participants have a clear intention throughout the experience and, if not, what are the problems. The second part is to investigate did participants select the action smoothly during the experience and, if not, what are the problems. The third part is to investigate did participants' have a consistent outcome comparison during the experience and, if not, what are the problems.

B.2 Part 1: Intention

- Did you know what's your goal/task when you play the game?
 - (if yes) How did you get what's your goal/task?
 - (if yes) What is your goal/task?
 - (if no) Why do you feel your goal/task is not clear?
- Did the conversation with Taylor (the protagonist of the game) provides you with a clear goal/intention?
 - Why do you think so?
- Did you easily get Taylor's situation through the story?
- Did Taylor's situation make you feel like to help him?
 - Why you (don't) want to help Taylor?

B.3 Part 2: Action Selection

- Did you know what to do when Taylor asks you a question?
- Did you think the way to make a selection is consistent?
- Did you easily get how to respond to Taylor?
 - Why do you think so?
 - (if no) Which part made it no so easy?
- Did you feel it was easy to make a selection from provided options?
 - Why do you think so?
- Did you feel confident when you make a selection?
 - Why do you think so?

- Were you satisfied with the provided options?
 - Why do you think so?
 - Does that make the selection easier or harder?
- Did you anticipate the outcome of each option and then select one match your intention?
 - (if yes) Did the actual outcome of the option match your expectation?
- Which matters more when you make a selection? a) Taylor's needs; b) Your own feelings; c) The responsibility of your role
- Did you have the feeling that "Taylor/The author wants me to select this option" during the experience?
 - (if yes) Where did you get this feeling? a) The conversation with Taylor; b) The option itself; c) The interface
 - (if yes) How do you think about this feeling?

B.4 Part 3: Outcome Comparison

- Did the way of communicating with Taylor match your expectation?
- Did you notice the feedback after you make a selection?
 - (if yes) Did the feedback match your expectation?
 - (if yes) Do you think the game provides enough feedback?
 - (if yes) Did you feel the feedback helps you know better whether the story was progressed as your expectation?
 - (if no) Did it make you confused?
- Did you have an expectation of how will the story progress when you selected an option?
 - (if yes) Did the story progressed as you expect after you selected the option?
 - (if no) Why don't you have it?
- Did you have the feeling of "I chose the correct/wrong option" after you see the outcome of the an option?
 - Which feeling did feel more often? (correct/wrong)
- Did you feel you were implied what will happen after you select an option?
 - (if yes) Where did you get this feeling? a) The conversation with Taylor; b) The option itself; c) The interface
 - (if yes) How do you think about this feeling?
- Did you feel the interaction in the game was consistent?

C The branch chart of the selected part of the story line

The following branch chart shows the selected part of the story line. It starts from the beginning of the story. The content in each cycle denotes the options users can choose.

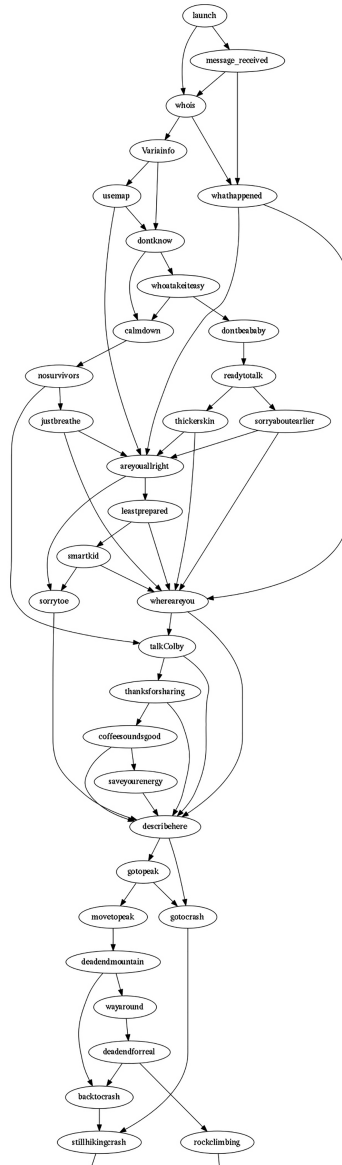


Figure 15: The branch chart of the selected part of the story line [38]

D Consent Form of the Experiment

D.1 Title of the research project

The Design of User Agency in Interactive Narrative

D.2 Names of members of the study team

Yijie Zhou

D.3 Description of the research

This research is part of the thesis work for MIXD490 Master's Thesis - Interaction Design at NTNU. The aim of the research is to evaluate a guideline for designing user agency in interactive narrative and investigate the correlation between user agency and user experience in interactive narrative. By participating in this activity, you will help us to gain valuable information to improve the guideline and have a better understanding of the correlation.

D.4 Description of human subject involvement

Participation involves testing prototypes created by the researcher. The user test will last approximately 10-15 minutes. Participates' behaviors will be observed by the researcher and notes will be written during the testing. After the testing, the participant will be provided with a digital survey on researcher's PC to collect their feedback regarding the user agency and user experience of testing prototypes.

D.5 Voluntary nature of participation

The participation in this project is voluntary. Even after signing the informed consent document, the participant may decide to leave the study at any time without penalty or loss of benefits to which you may otherwise be entitled. You may skip or refuse to answer any question without affecting your study compensation.

D.6 Risks and discomforts of participation

This project is deemed as no more than minimal risk. The study team does not foresee or anticipate any risk greater than that encountered in your routine daily activities.

D.7 Expected benefits to subjects or to others

Although you may not receive direct benefit from your participation, others may ultimately benefit from the knowledge obtained in this study.

D.8 Costs to the subject resulting from participation in the study

There won't be any costs resulting from participation in the study.

D.9 Incentives to the subject for participation in the study

There will be no incentives to you for participation in the study.

D.10 Confidentiality of records/data

You will not be identified in any reports in this study. This study is anonymous. We will not be collecting or retaining any information about your identity or that could indirectly identify you. The records of this study will be kept strictly confidential. The data will be stored until 1st August 2019, and eliminated after. It is voluntary to participate, and you can at any time withdraw your consent without starting the reason. The intrinsic anonymity of the data will prevent us to eliminate any data already aggregated in the system until the date previously specified.

D.11 GDPR Compliance

a) Received data will be deleted after submission of the final thesis for MIXD490 Master's Thesis - Interaction Design, at the latest 1st August 2019. b) The data will be stored in researcher's PC, only the researcher will have access to the data. c) Given the nature of the anonymized data, there will be no personal data record and it will be impossible to request a correction or deletion of the collected data before the end of the study, contact Yijie Zhou for further information regarding the handling of your data.

D.12 Contact Information

Yijie Zhou phone: 40573692 email: yijiezhou.ux@gmail.com

D.13 Documentation of the consent

One copy of this document will be kept in the research records of this study. Also, you will be given a copy to keep.

D.14 Consent

I have read of the information given above. Yijie Zhou has offered to answer any questions I may have concerning the study. I hereby consent to participate in the study.

Please sign below if you are willing to participate in the research project.

Name:

Date:

