Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Information Technology and Electrical Engineering
Department of Computer Science

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Exploring games for ethics education of Computer Science Students

Master's thesis in MSIT
Supervisor: Monica Divitini
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Abstract

Recent developments in the field of computer science have caused concerns regarding the ethics of the development, application and use of these technologies. Technologies that are still emerging, such as the new wave of Artificial intelligence based tools, have caused discussions in the media regarding the role of ethics education for developers aspiring to create these tools. Organisations, such as the Norwegian Society of Engineers and Technologists (NITO), have expressed that there is a need to implement ethics education within the educational programmes of future programmers (Vaaland 2022a). NITO has also expressed that this education should involve the student getting to practice on handling ethical dilemmas.

This thesis explores how education within ethics in the field of computer science could be supplemented by using games made specifically to facilitate interaction with various ethical scenarios. Games were thought to be a fitting tool due to their nature as an interactive medium, allowing players to simulate making decisions and seeing the consequences of them.

The work started with a literature review that was performed to get a comprehensive view of how games have been developed to supplement ethics education. The resulting documents were used to develop two game concepts, which were modified and developed through an iterative design process, consisting of three iterations. The first iteration consisting of interviews with three relevant experts within computer science, ethics and games. The second iteration consisting of interviews with computer science students. The third iteration consisting of an interview that included a full play session of two prototypes. The results of the research performed in this thesis consists of the design and prototypes of two games and the evaluation of them. The first game is a card-based competitive game called Startup-superfight and the second is a narrative-driven discussion game called Consultant Tycoon.

The last iteration of the game concepts and their associated prototypes received mostly positive feedback. However, there was observed a difference in how the conversations between students take shape when playing the prototypes. These differences are thought to partly come from the design of the prototypes themselves, and partially from the ways collaborative and competitive aspects of the games could affect conversations. The game concepts and prototype evaluations presented in this thesis could serve as inspiration for the future development of serious games for ethics education of computer science students.

Sammendrag

Nylige utviklinger innen datavitenskap har forårsaket uro angående etikken rundt utvikling og bruk av disse teknologiene. Teknologier som fortsatt er under stor endring, slik som den nye bølgen av kunstig intelligens-baserte redskaper, har skapt diskusjoner i media rundt rollen til etisk utdanning for utviklere som ønsker å skape slike redskaper. Organisasjoner slik som Norges Ingeniør- og Teknologorganisasjon (NITO), har uttrykt at de mener det er stor trang for å implementere etikkutdanning i utdanningsplanen for fremtidige utviklere (Vaaland 2022a). NITO har også uttrykt at denne utdanning burde involvere at studenten får praktisk erfaring med å håndtere etiske dilemma.

Denne oppgaven vil utforske hvordan utdanning innen etikk i feltet datavitenskap kan bli supplementert ved bruk av spill skapt spesifikt for å fasilitere interaksjon med forskjellige etiske scenarier. Spill var valgt som et passende redskap på grunn av dets natur som et interaktivt medium, som lar spillere simulere å gjøre beslutninger og se konsekvensene av dem.

Arbeidet startet med en litteraturgjennomgang som var utført for å få et helhetlig syn på hvordan spill har blitt utviklet for å supplere etikkutdanning. De resulterende dokumentene var brukt for å utvikle to spill-konsepter, som var modifisert og utviklet gjennom en iterativ designprosess, bestående av tre iterasjoner. Den første iterasjonen var oppbygget av intervjuer med tre relevante eksperter innen datavitenskap, etikk og spill. Den andre iterasjonen var oppbygget av intervjuer med datavitenskap studenter. Den tredje iterasjonen var oppbygget av et intervju som inkluderte en full gjennomspilling av begge prototypene. Resultatene av forskningen utført i denne oppgaven består av designet og prototypene av to spill og evalueringen av dem. Det første spillet er et papirbasert kompetitivt kortspill kalt Startup-Superfight, og det andre er et narrativ-drevet diskusjon spill kalt Consultant Tycoon.

Den siste iterasjonen av spill-konseptene og deres assosierte prototyper mottok hovedsakelig positiv tilbakemelding. Derimot var det observert en forskjell i hvordan samtalene mellom spillerne tok plass under gjennomspillingen. Disse forskjellene er tenkt å komme fra designet av prototypene selv, og til dels fra hvordan de kompetitive og kooperative aspektene av spillene kan påvirke samtalene. Spillkonsept og prototype evalueringene presentert i denne oppgaven kan fungere som inspirasjon for fremtidig utvikling av seriøse spill for etikk utdanning for datavitenskap studenter.

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Chapter 1

Introduction

1.1 Motivation

Ethics in the context of computer science has become a prominent topic in the media. Concerns regarding social media algorithms have sparked demands for more regulations of social media companies (Vaaland 2021). Beyond this, a recent wave of high profile Artificial Intelligence (AI) tools have led to demands for more comprehensive regulations on the development of such tools from prominent academics (Vaaland 2022b). Others, such as the Norwegian Society of Engineers and Technologists (NITO) have also asked for more ethics education to be integrated into educational programmes for programmers (Vaaland 2022a). NITO specifically mentioned that these students, similarly to students preparing to become doctors and lawyers, should have the opportunity to practice handling ethical dilemmas at every stage of their education.

Beyond the academic computer science circles in Norway, there is also a documented public demand for ethics training for scientists across the EU, with a Eurobarometer poll from 2014 reporting that 84% of participants agreeing that there should be mandatory ethics training on scientific research ethics (European-Commission 2014). The same poll also found that 83% of participants agreed that "*like doctors, all young scientists should take an oath to respect ethical principles and relevant legislation*". While this data is not specific for computer scientists, this is a scientific field that has changed many sectors of the economy.

The importance of ethics education within the field of computer science has also been recognised by organisations working in the field. The Association for Computing Machinery (ACM) created a code of ethics and professional conduct, which was described by the then-president Cherri M. Pancake as *a contract among ourselves as professionals, as well as a public statement of our understanding of the responsibilities the profession has to the larger society that it serves* (Computing Machinery 2018). This code of ethics was also supplemented by a collection of ethical cases.

As computers become involved in more and more industries, the potential impact of ethical education for computer scientists could be pivotal. Technical decisions can

have huge ethical repercussions, and we have already seen grim signs of where technology can lead us without proper guidance, like corporations selling user data(Douglas Busvine 2022) or racist AI(Schwartz 2019). The public interest in improved ethics education for young researchers alongside the high profile controversies around emerging technologies could be interpreted as an indication that there is a need for improved tools to aid ethics education for young computer scientists. Based on these observations, the authors of this thesis, from this point forward referred to as *the team*, wanted to develop and evaluate a serious game centred around helping computer science students practice ethical decision-making.

The team believes that ethics education for computer science students could be supported by the use of games. Games as a medium can have aspects of simulation and narratives, which the team thinks could prove itself useful in creating a tool for ethics education. The team thinks that a game applied to the field of ethics education for computer science students could allow students to practice ethical decision-making and discussion in a safe environment, a form of education requested by NITO (Vaaland 2022a). There have been several studies on use of video games in education, and they seem to support a similar sentiment (Lin et al. 2022)(Xenos and Velli 2020).

1.2 Context

This project was conducted as part of a master's degree project for the Master of Science in Informatics (MSIT) in the Department of Computer Science(IDI) at the Norwegian University of Science and Technology. This project was preceded by a preparatory project where the team looked into the literature surrounding games for ethics education, to serve as a basis for this project (Nummedal and Hjaltason 2022).

Both this project and the preparatory project were done with Monica Divitini as supervisor.

1.3 Problem definition

1.3.1 Learning objective

It is established in Briggle et al. 2015 that there is widespread agreement that STEM fields should have ethics training during their education, but it is also stated that there is no consensus as to what explicitly should be taught, and how. The National Academies Keck Center conducted a workshop in 2009 to review current ethics education for STEM students and identify core ethical skills STEM education should foster, and summarized their findings in the paper Engineering 2009. An important observation made during this workshop is that current education does not properly train these skills, as it was difficult to know how to properly measure a

student's progress, and it was found that the students failed to grasp the significance of the ethical considerations involved in their work before they encountered genuine ethical quandaries in practice.

Due to the complexities when it comes to defining specific learning objectives in STEM fields, this project will mainly focus on presenting relevant scenarios and letting students spend time discussing or reflecting on these scenarios. The scenarios will be discussed with the context of an industry document regarding ethics for computer scientists, specifically the Code booklet by the association of computing machinery (Computing Machinery 2018).

1.3.2 Research questions

The research questions that will be explored in this thesis are divided into the following questions and sub-questions.

- RQ1 How can games be designed to facilitate for ethics discussion for computer science students?
  - RQ1.1 How could competitiveness be implemented into a game to facilitate for ethics education for computer science students?
  - RQ1.2 How could collaboration be implemented into a game to facilitate for ethics education for computer science students?

1.4 Research method

The overarching methodology used in this project is Design Science Research. Design science research is a paradigm that aims to acquire new knowledge through the creation of artefacts based on existing kernel theories. These kernel theories are then applied through the experience, creativity, intuition, and problem-solving capabilities of the researchers (Hevner et al. 2004).

This research paradigm is thought to be well suited for the challenges described in Section 1.3.2, due to its focus on problem-solving rooted in kernel theories. The created artefact in the context of this project is a family of game designs and a prototype to generate assets for these game designs. This project builds upon a preparatory project that also used a Design Science Research methodology. The main contribution from the preparatory project to the methodology of this project is a literature review. The methodology of the literature review and the later analysis is described used for the concept creation is discussed in chapter 2.

Creation of artefacts using Design Science Research is partitioned into three cycles: relevance, rigour and design. The relevance cycles aim to gather more information regarding the application context. This information will help to define both the requirements for the research and acceptance criteria to be used in the final evalu-

ation of the results. During the development process, relevance work was performed through a series of interviews with relevant experts and user group representatives.

Rigour cycles involve drawing from the existing base of knowledge on the subject in question. These cycles are performed to ensure that the artefacts created are based on existing literature and ensure that the artefact and associated research has a degree of novelty and innovativeness. The rigour cycle in this project mainly revolves around the literature review performed in the preparatory project.

Design cycles consists of activities that iteratively improve the artefact. Design cycles activities consist of construction of artefacts, evaluation and feedback to refine the artefact design. These iterations are performed to make sure the artefact contributes to solving the research questions, and to make sure it fulfils the acceptance criteria. The requirements are acquired from the relevance cycles and the methods are drawn from the rigour cycles. The design cycles in this thesis consist of concept development, concept revision and evaluation from user tests. These activities are represented in multiple revisions of the game concepts.

An overview of the research activities involved in this thesis and how they relate to each other is displayed in Figure 1.2. The overview is inspired by the Design Science Research cycles shown in Figure 1.1 and each activity uses a symbol based on the relevant cycle type.

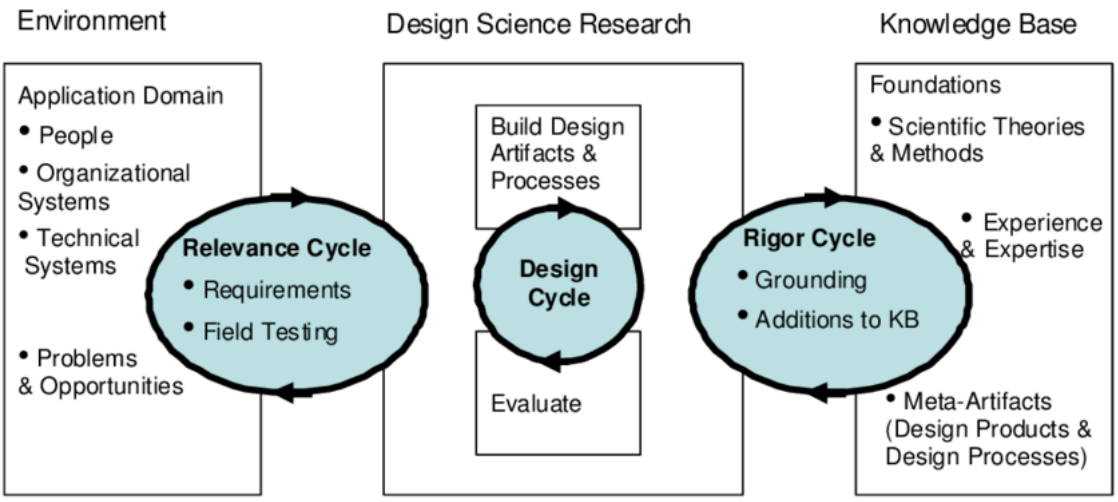


Figure 1.1: Design Science Research cycles, borrowed from Hevner 2007

1.5 Contribution

This thesis contributes to the field of serious games for ethics education for young computer scientists by presenting a set of serious game designs and evaluations based on a previously performed literature review. The literature review revealed that there were few projects that have attempted to apply serious games for ethics education for computer scientists in general. Using the knowledge gained from the literature review, the team attempted to apply theory from the previous projects

on serious games for ethics education found in the literature review to develop and test a collection of games for computer scientists.

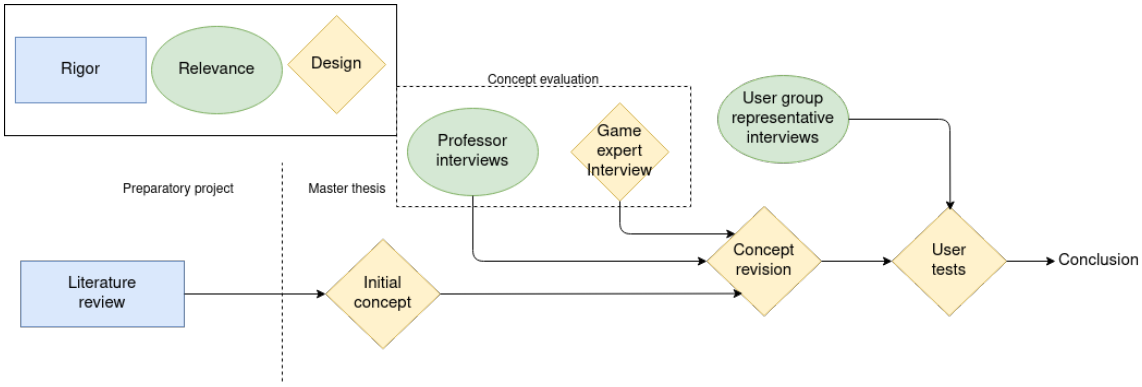


Figure 1.2: Research activities in the preparatory project and master thesis

1.6 Ethics

Due to the thesis' reliance on data gathered from interviews and users tests, the team had to go through an application process to get approval for the use of personal data. The application can be seen in its entirety in Section D. The application was automatically accepted due to data gathered during these activities being considered low risk. The application included an initial set of interview guides and consent forms for participants, these are linked in Table 1.1. During the various activities, the relatively broad questions from the initial interview guides have been made more specific. These versions of the interview guides can be seen in the method sections in the specific iteration chapters.

Participant	Consent form	Interview guide
Computer science professor	E	F
Game expert	G	H
Ethics professor	E	F
Computer science student	I	J

Table 1.1: Participant group and associated consent forms and initial interview guides

1.7 Outline

This section describes how the rest of the thesis is divided. Section 2 presents the preparatory project and later analysis of the results from that project. It presents the theoretical background of the project's perspective on ethics for computer scientists. In addition to this, it describes the methodology and results of the literature review that provided a perspective into the state of the art. Chapter 3 describes

the process of creating the initial game concepts, rooted in the background literature. Chapter 4 describes the theoretical background of a set of cases thought to be relevant to computer science students. These ethical cases will be utilised in the development of the game prototypes. Chapter 5 describes the first iteration of the prototypes and an evaluation of the prototypes by a series of interviews with three relevant experts. Chapter 6 focuses on the second iteration of the game concepts and prototypes, before evaluating the prototype with a set of interviews with computer science students. The final iteration of the game concepts and prototypes are described and evaluated in chapter 7. The final iteration is evaluated through a group interview where a group of computer science students play the games. The final discussions for the thesis and its conclusions are written in chapter 8.

Chapter 2

Background

This project builds upon a previous preparatory report. The previous report consisted of a short introduction to relevant theory, a literature review and an analysis of two previously developed games to teach ethics and facilitate for ethical reflection and decision-making. This was performed to get insight into the existing research done on the topic. This chapter will briefly describe the methodology used and summarise the results of this process.

2.1 Ethics for computer scientists

During the initial phase of the preparatory project, the team explored how the field of ethics for computer scientists has been discussed in literature. This was thought to be necessary as the team wanted to uncover potentially relevant terminology and perspectives that would be necessary to perform a literature review. A problem the team encountered in this process was the fact that terminology in this field has been used inconsistently. Terminology can often change as the understanding of the technologies they describe change (Johnson 2001). Due to the inconsistent terminology used in the field of ethics for computer scientists, the team chose to continue describing the field as ethics for computer scientists.

Because of the contributions in this thesis not laying within the field of ethics, the team thought it was important to anchor their perspective of ethics for computer science within the work of an established organisation within the field. To fill this role, the team chose to utilise a booklet from the Association for Computing Machinery (ACM), which is distributed as a supplement to their code of ethics and professional conduct, called *The Code*. From this work, the team noticed that ACM presented principles and guidelines for how to act, before describing how they were applied through a series of cases describe in the later part of the booklet Computing Machinery 2018. Several of the situations showed how multiple answers can all have different merits in them at the same time, as seen in their discussions regarding case study 2. This understanding of ethical dilemmas was something the team wanted to borrow for this thesis.

2.2 Literature review

The literature review was performed on the ACM digital library and Web of Science, 23rd of November 2022. The query was performed with the keywords 'Ethics AND gam* AND (Teach* OR educat* OR learn*)', applying this filter to the abstracts sections. An additional filter was placed, utilising the query 'Ethic* OR gam*' on the title. The query resulted in a total of 234 results with varying degrees of relevance, which lead the team to perform a round of manual screening process where each document checked for eligibility and relevance.

Documents acquired through the literature search were considered eligible if these following requirements were met:

- Document must be in English
- Document must have an abstract
- Document must be published in a peer-reviewed journal or published as a conference paper in a relevant conference.

Additionally, documents were considered relevant if one or more of these following requirements are met:

- The document must present a serious game to engage in ethical reflection or education
- The document must evaluate a serious game intended to engage players in ethical reflection or education
- The document must evaluate one or more features of serious games for moral or ethical engagement, action or reflection
- The document must present a game design framework for designing serious games for ethics education
- The document must present a framework or methodology for utilising games in ethics education

Database	ACM	Web of Science	Total
Search Results	86	148	234
Post-screening	5	9	14

Table 2.1: Overview of databases and results

2.3 Review of previous games

The team also analysed two games for ethics education that were discovered outside the literature review, specifically Quandary and Apperception. Quandary is a single player game taking place in a human settlement on an alien planet. The game is centred around a set of ethical situations where the player has to solve a problem. When the problems are presented, the player finds out that different settlers have differing perspectives on how these situations should be resolved. This game was found interesting as it helps the player recognise perspectives and world-views among the settlers and how these perspectives can be reflected in the actions the player can take.

The other game was called Apperception and is a classroom oriented game where the game focuses on discussion regarding ethical dilemmas. The players are tasked with ranking possible options for how to deal with a dilemma by how much the player prefers them. After the player has ranked the options, they have to discuss the options with their classmates. This game had little narrative and was mostly based around discussing the ethical dilemmas, in contrast with Quandary, which was mostly narrative driven.

2.4 Analysis of results

Following the literature review and review of existing game titles for ethics education, the team wanted to explore the potential gaps in the discovered knowledge base. To do this, the team reviewed the game titles discovered during the preparatory project and tried to find any shared traits that could indicate an aspect of ethics game development that has been left unexplored.

To visualize the results of the literature search, the team categorised the games described in the papers found in the literature review. The categorisation mainly focused on how the genres of the games, as this could highlight if there are any commonalities or potential gaps in the kinds of games that have been developed. In Table 2.2, the team has decided to categorise games by if they simulate workplace simulations, if they are single player experiences and the genre of the game. When reading Table 2.2 it is also worth noting that three documents discuss the same game, but are not true duplicates and are therefore presented together.

Document	Genre	Simulates workplace situation	Single player
Veziridis et al. 2017	War sim	x	x
Xenos and Velli 2020	Narrative driven	x	x
Sari et al. 2021	Narrative driven	x	x
Lin et al. 2022	Narrative driven	x	x
Lorenzini et al. 2015	Narrative driven	x	x
Melcer et al. 2020 AND Grasse et al. 2021 AND Nel and Carroll 2017	Narrative driven	x	x
Diez and Melcer 2020	Narrative driven	x	x
Jagger et al. 2016	Narrative driven	x	x
Hutson and Fulcher 2022	Stealth		x
count	N/A	8	9

Table 2.2: Overview of design decisions

The games found in the literature review reveal a pattern. Most of the games found in the literature review are narrative driven games that simulate workplace situations. The games have not been shown to explore multiplayer experiences as a way to practice the social aspect of ethics. This leaves Apperception as the only game found in the preparatory project that places an emphasis on discussion between players as a way to engage with ethical dilemmas.

Among the documents found in the literature review, were documents that also described guidelines for the utilisation and development of games for ethics education. Table 2.3.

Document	Contribution
Mcdaniel and Fiore 2012	Presents a set og best practices guidelines for the development of ethical learning games
Schrier 2015	Presents a framework for using video games in ethics education
Nardo and Gaydos 2021	Presents three principles for design of educational ethics games

Table 2.3: overview over frameworks and guidelines

Following this analysis, the team wanted to formulate a new set of guidelines that could later be used to create an initial game concept. Before starting the initial concept creation process, the team applied the guidelines prescribed in (Mcdaniel and Fiore 2012) as a set of relevant suggestions. Particular emphasis was put on their recommendation that ethical decision-making should not by itself be the main gameplay. The team formulated this recommendation as ethics being a prominent subsystem within the game.

The team followed the recommendations from Nardo and Gaydos 2021, to define a set of recommendations for an ethics subsystem. Nardo and Gaydos suggested that systems representing ethical issues should attempt to tackle the potential wickedness and ambiguity of the problems. Nardo and Gaydos prescribed three principles were in their paper. To open the game concepts up for an "ambiguity model", a requirement was set to avoid direct ethical judgements and consequences. The concepts must also attempt to allow players to experience goal driven meaning negotiation through a separation between the gameplay that is considered instrumental and the gameplay aspects that represent ethical decision-making. Nardo and Gaydos recommend following the game up with directed discussion of the game experience as a way to understand ethics with regard to the social and professional standards that might be relevant. The directed discussion will be a requirement of the game that will bridge the game experience and a formal learning context.

Chapter 3

Concept creation and project planning

This chapter will revolve around the concept creation process, preceding the development and evaluation. Here you will find the process the team underwent to decide on a general game concept.

3.1 Concept creation

After having decided on the exercises to focus the game around, specifically practising ethical decision-making and discussion, the team needed to come up with a game concept that would fulfil this vision. While many game concepts were spontaneous ideas that sounded entertaining, this project and serious games in general most often already have a goal in mind, and needs to be fitted with a game concept to fit the required learning objective. Because of this, the team began with a brainstorming workshop where the team tried to come up with different entertaining ways of teaching these skills. The team decided to look for commercial games that either simulated workplace environments similar to those of computer science students and graduates, or that focus on creating topical discussion. This commercial game would then be used as a core concept, the team would apply ethics subsystems to.

3.1.1 Business simulation game

As the team had established some requirements for what way the game should present the player with ethical decisions, and the research suggested a simulation of a workplace scenario is a good medium for learning about relevant ethical situations, the team settled quickly on a business simulation game.

Specifically, a business simulation game inspired by the commercial game title *Game Dev Tycoon* (Games 2013). This concept lent itself well as a base game concept for a single player ethics education game for software engineers, as this game already

simulates the professional practice of a subset of software engineers. Using a narrative driven business simulation game, the team wanted to explore the possibility of having students play through the game, develop experiences with the same story and ethical dilemmas, before discussing them in a classroom setting.

As discussed in Mcdaniel and Fiore 2012, it is preferable for ethical decision-making to be an aspect of what you are doing, but not be the direct gameplay loop or goal. Decisions should also not have guaranteed "good" or "bad" predetermined outcomes, as this does not reflect reality. Within this business simulation game idea, the team thought of many different ways to satisfy these ideals. By having the player run a business, doing tasks like responding to pressing matters and assigning employees, the ethical aspects will instead be intertwined with the different mechanics in the game. The main goal will be to keep the business running, but each choice made will have a level of ethical impact on the company, the employees, and the world around them. Here are some different ideas the team brainstormed that could affect a company:

- Employees could have preferences in what types of work they like to do, or be motivated more by the work they're doing than the money. Individuals or companies that want to deal with environmentally friendly companies might not be interested in working with a company that has mostly been doing work in coal and oil (Sandberg 2023).
- Contracts might start offering less or require more work for the same pay, because your employees have been doing quick jobs with little attention to detail.
- You could get more talented recruits because more people apply when you have a positive media image (Schaer 2021).
- Making conflicting choices by your investors might have consequences
- Some choices might have consequences like data leaks and other huge scandals that can even end in legal issues.

The team therefore decided to design a prototype where the player is in charge of a tech startup. The player can choose between recruiting new employees, or assigning employees to either updates for their own software, or consultant contracts from other companies. The team wanted each recruit to have preferences, a preset salary and a level of work power. The contracts and updates were intended to have a reward amount in cash, as well as an amount of work power needed. The team wanted each contract to have a specific industry in mind, and every contract and update to have certain traits to implement ethical aspects. There would also be random events showing up with consequences based on the player's reaction.

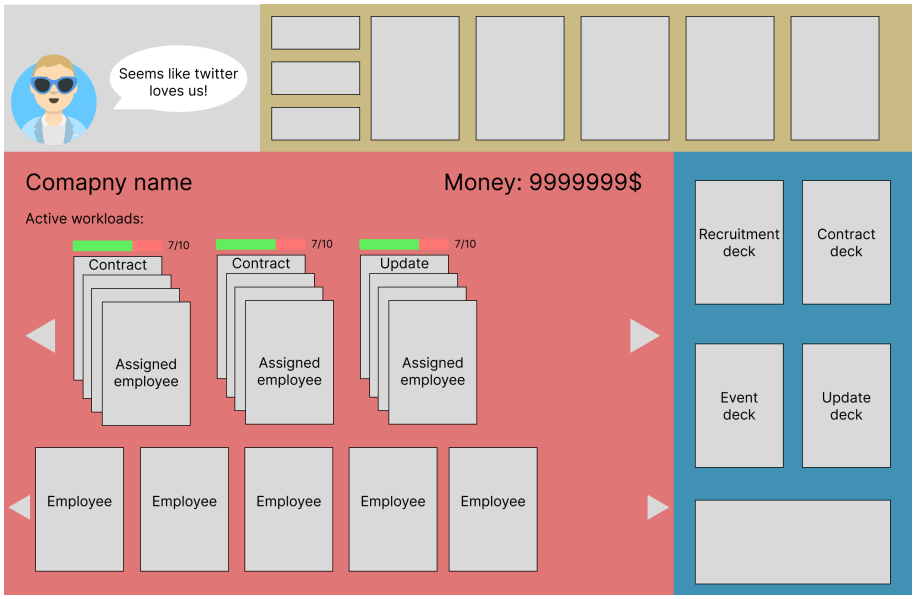
The team wanted a Chief Executive Officer (CEO) type character to be in the game, to convey certain "behind-the-scenes" mechanics to our player, like hinting at why certain things might have happened, or keep us updated about things happening around us. This CEO character would also work as a tutorial medium, who could explain how the mechanics worked the first time around.

For the "behind-the-scenes" mechanics, the team wanted the traits of the different jobs taken to be stored and somehow affect "dice-rolls" that controlled what recruits, contracts and updates the player would get, and what events happened. The team also wanted this to have an effect on the current employees' motivation and how they might react to events themselves.

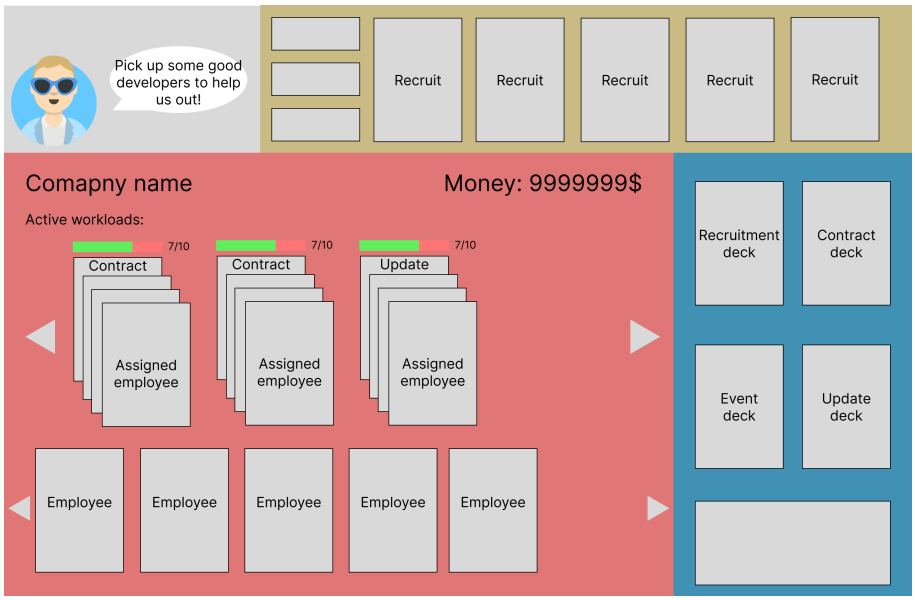
As this game ended up as a single player idea, the team had to think of a way to make this more applicable to a classroom setting, since this was part of the original goal. To fulfil this, the team believed it would be a good idea to include some sort of statistics system that could be shared with whoever is running the class, so that statistics could be discussed in the class, showing students what choices their classmates were choosing, and discuss their own results.

storyboard

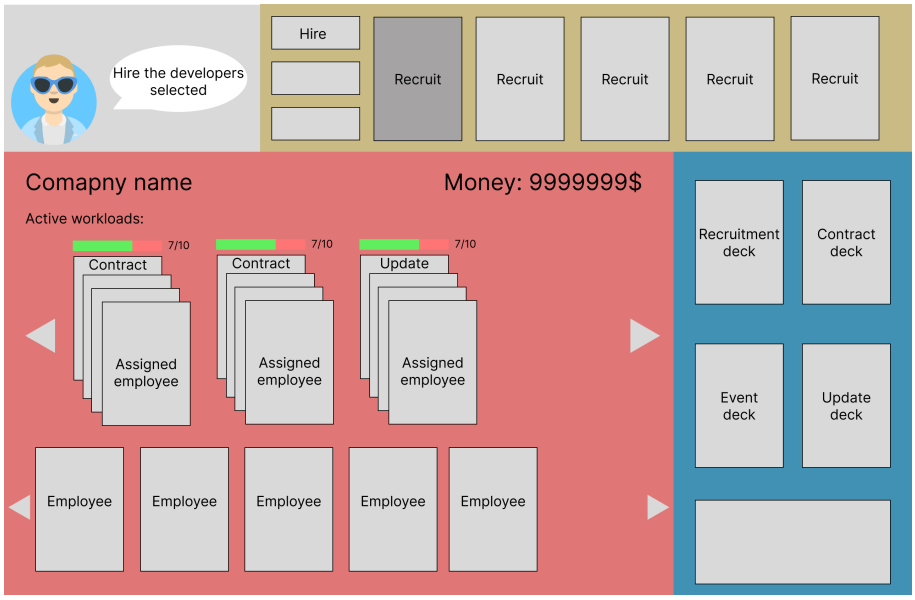
In this section a storyboard will go through the basic game loop for the initial prototype of Consultant Tycoon.



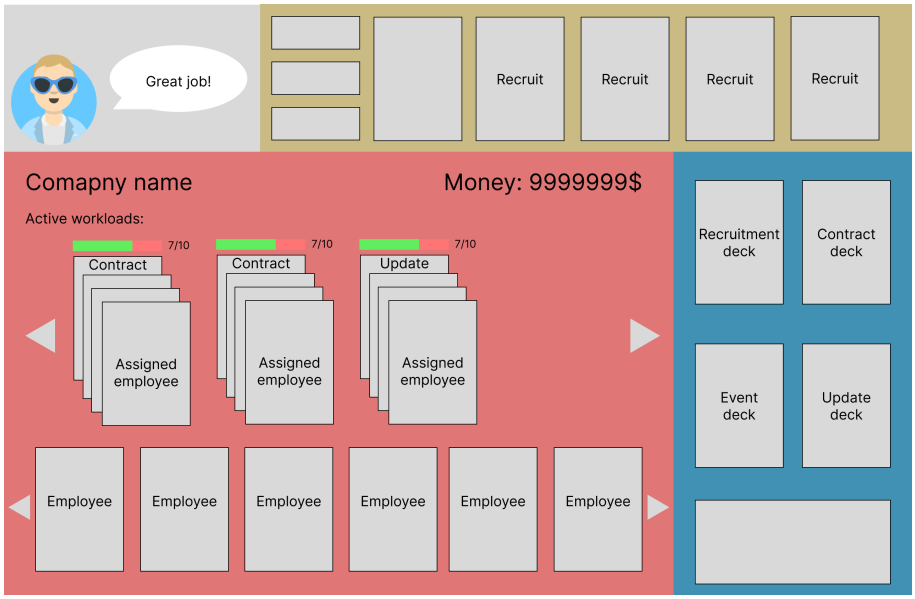
The image above shows the basic screen that will be shown to the player. The CEO sits in the top left corner and is meant to work as a helping hand in informing the player of what to do next. The 5 tall slots in the gold area is where currently relevant cards will be displayed, and the 3 long slots will show text when cards are selected, giving the player alternatives in how to handle the card. In the blue area, the 4 decks are represented, and a player can click on any of the decks except the event deck, to make 5 cards appear in the gold area. In the red area, a list of currently initiated job contracts are displayed, along with a progress bar and its assigned employees. Below that is a list of those currently employed but not assigned a job. The button below the decks is meant to be used to end the day.



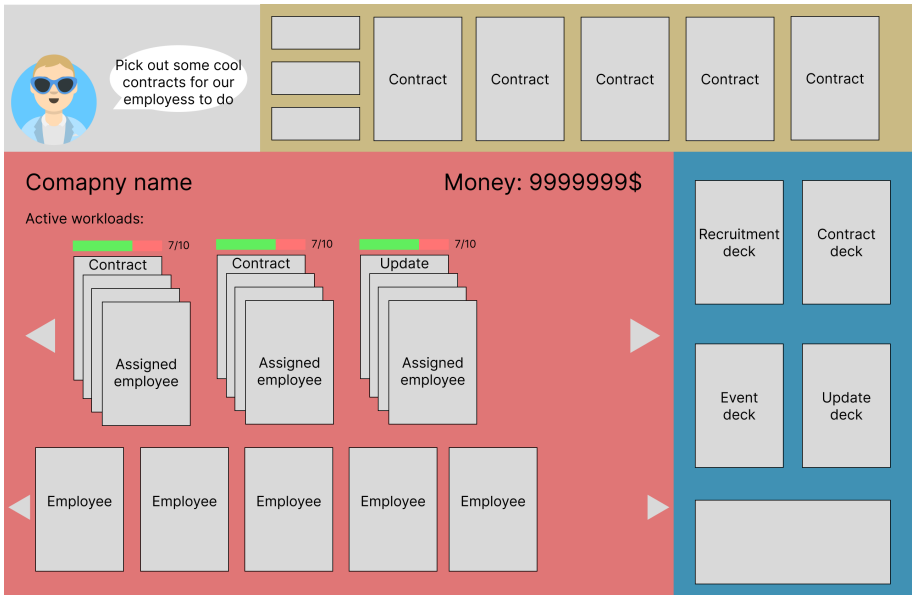
In the image above, the player has clicked the recruitment deck to hire another employee. 5 Recruits are therefore added to the gold area. In a finished prototype they would each have names, associated work power and salaries displayed on their cards.



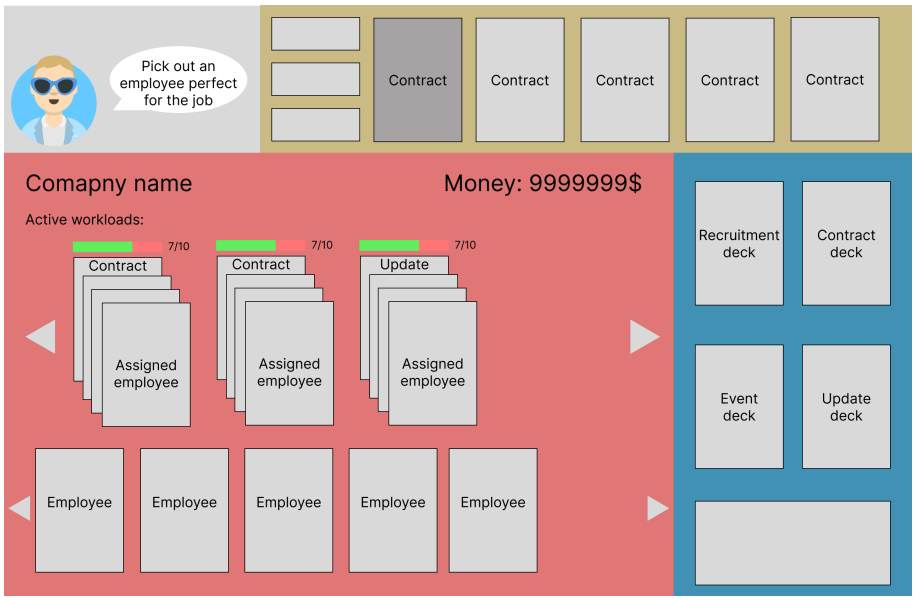
In the image above, the player has selected a potential employee to recruit. Throughout these storyboards, the CEO gives directions as to what the player should be doing, except in the stage where no deck is selected.



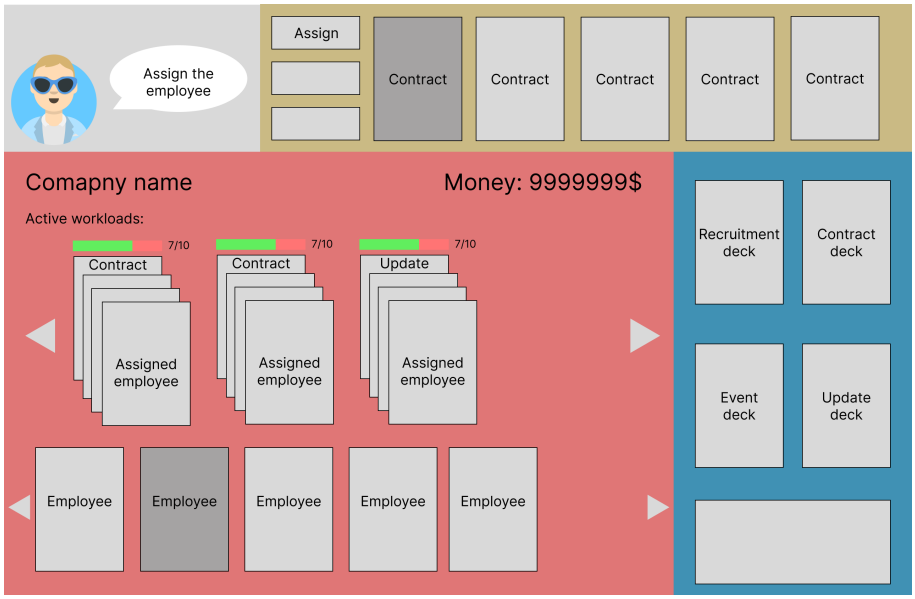
In the image above, a new employee has been hired.



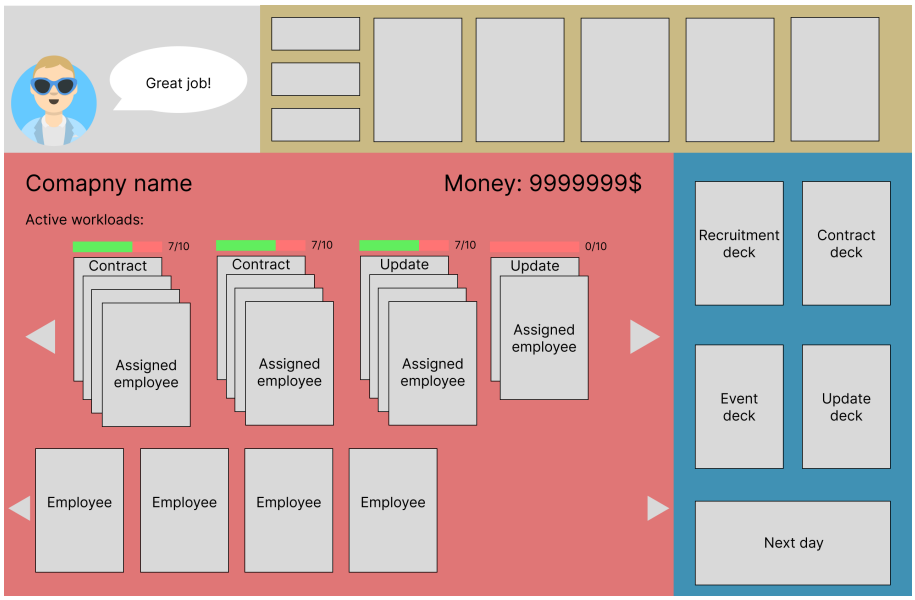
In the image above, the player has clicked on the contract deck.



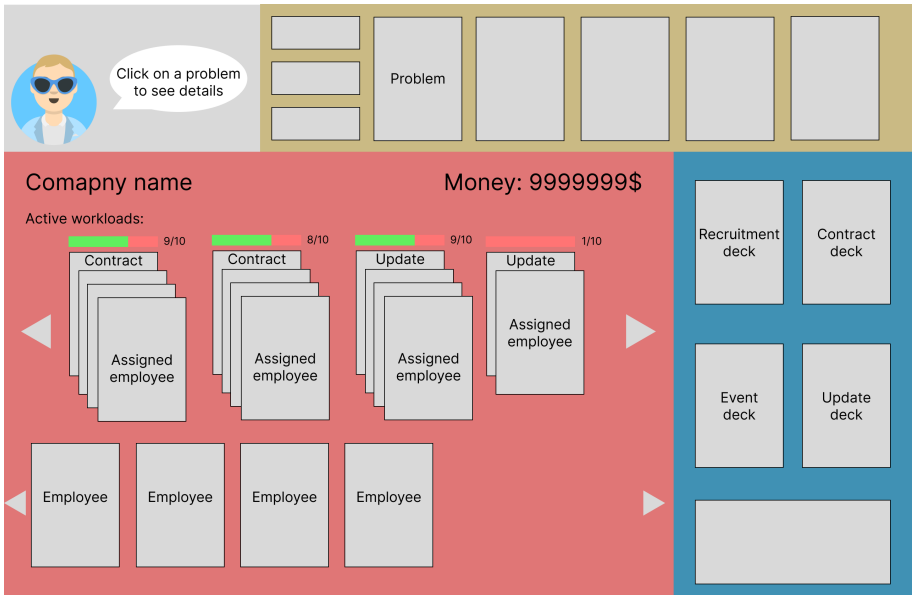
In the image above, the player has selected a contract, and must now select one or more employees, to which they can assign to the new contract.



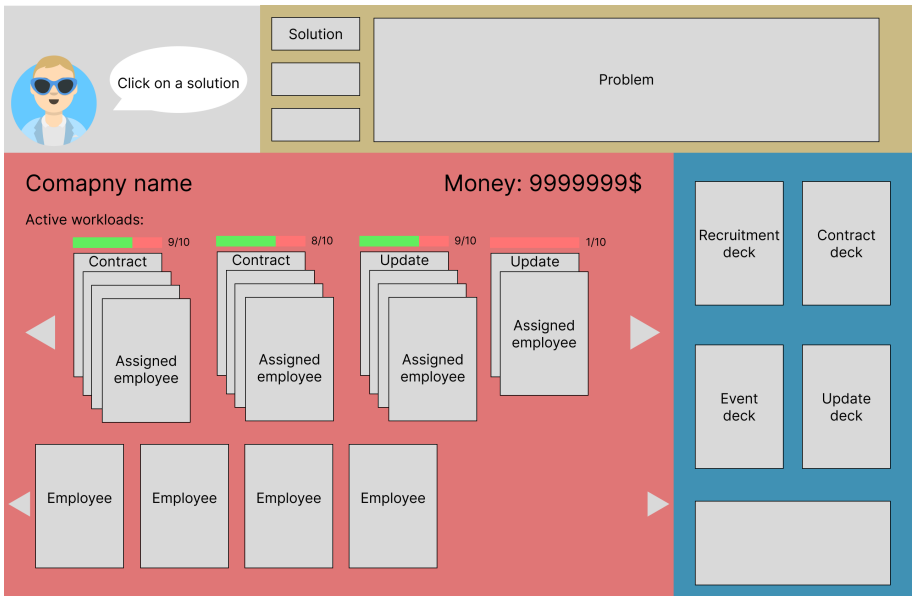
In the image above, the player has selected an employee.



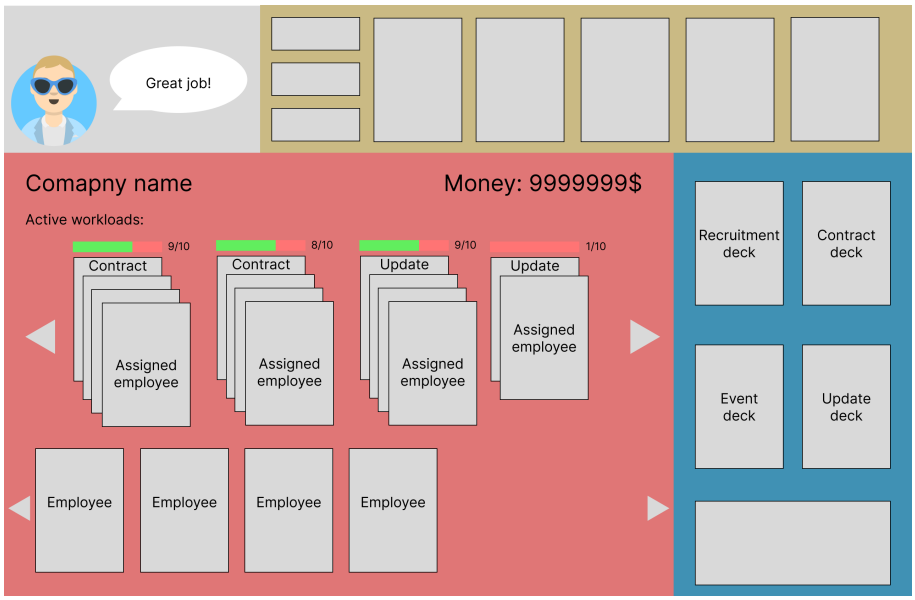
In the image above, the employee has been assigned to the job.



In the image above a day has passed since the last image. Progress has been made, and a problem has occurred on one of the projects.



In the image above, the player has clicked on- the problem, and is given the option to pick a solution. In a prototype, all 3 slots would be filled with 3 separate responses, and the large area for the problem would be filled with context on the issue.



Here, the problem has been resolved.

3.1.2 Business ethics card game

The team wanted to brainstorm an idea that could fit in a classroom setting, as well as attempt to utilize a competitive aspect to increase engagement. To do this, the team explored multiplayer games that have communication as a core aspect of the game. The team decided that the focus on this prototype would be ethical analysis and stakeholder recognition, and use ethical discussion as its main mechanic. Instead

of a game where the point would be to personally seem the most ethically correct, the team instead wanted to create a game that emphasized the player's ability to assess the ethical aspects of a situation and different solutions with fellow students.

At first the team thought of the game "Cards against humanity", where players are presented with a card with blank spaces and are supposed to provide their own card, where the most "fun" answer is chosen. The team considered a game where 3 players acted as Chief Executive Officer(CEO), Chief Technical Officer(CTO) and Chief Financial Officer(CF) who presented the players with a dilemma, and the other players would act as employees with ideas that would be judged by the CEO, CTO and CFO in terms of ethical impact, feasibility, and economic gain. The CEO is in charge of the company's overall management. The CTO is responsible for a company's technological strategy. The CFO manages a company's financial operations. The team believed this mix of roles could let the players discuss the technologies from different angles, and hoped the role-play aspect could increase immersion.

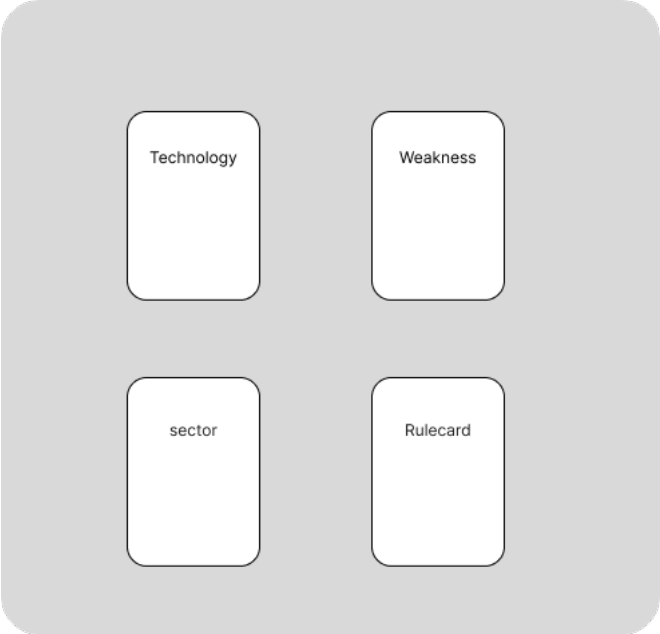
The team believed this concept had some potential, but that it would be lacking in a few areas. Firstly, the burden of having 3 judges can make the game troublesome to put into practice. Additionally, the team believed that the concept was lacking in terms of interaction between the players.

After some internal evaluation, the team chose to take inspiration from a similar card game, "SuperFight". SuperFight is a card game where one player creates a supervillain using random cards, and the main mechanic is the remaining players creating superheroes of their own and discussing which would be best at battling the supervillain. The players would then add different weaknesses to each other's superheroes to improve their own in comparison. This would fit better for our concept, as discussion was already a main mechanic in the inspiration. Another game that inspired us, with similar traits, is the game "Snake oil". In the game snake oil, one player is presented with a predicament, and the other players need to use the cards provided to them to create a product that will help out the customer the most.

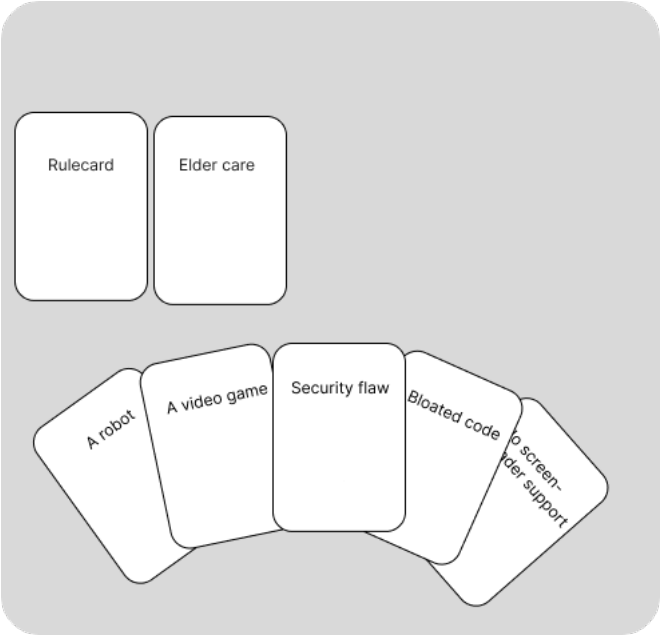
Using these ideas as a basis, the team thought of a game where one player would act as a tech investor, and the other players would act as startups. The investor would present the other players with an industry or market they would like to invest in, and the other players would use their cards and knowledge of the industry to conceptualize a startup for that market. Then the round would start with each player in turn pitching their idea to the investor. At the end of any pitch, other players could then add weaknesses to their competitor's ideas using their weakness cards. After everyone has finished their pitch, the investor would then have to consider the feasibility, financial potential and ethical implications of the different ideas, and pick which one they would like to invest in. The player who wins the investment keeps the investment card, and the first to 5 cards wins. The role of investor rotates clockwise after each round, or could permanently stay with a teaching assistant.

Storyboard

Here a storyboard will go through the basic game loop for the initial prototype of startupsuperfight.



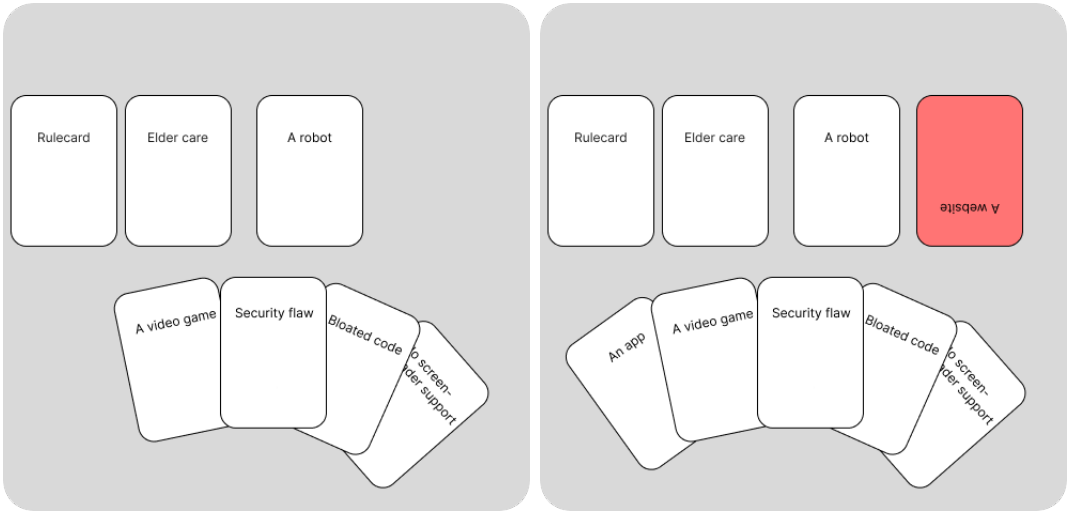
The image above shows how the four decks are thought to look, when the backside of the cards are pointed upwards.



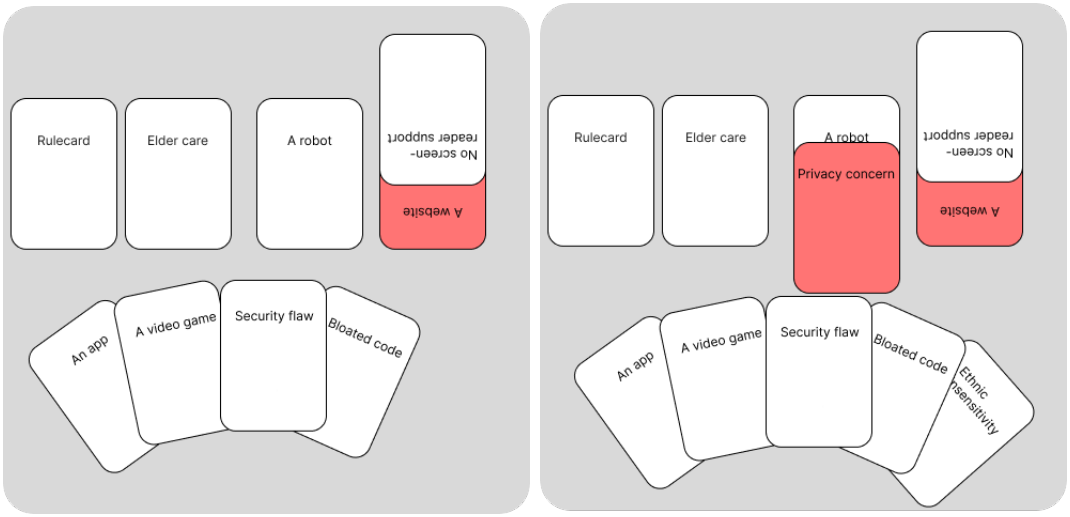
The image above shows how the table will look during the beginning of each round of the game loop for the individual player. The curved shape of the five cards at the bottom of the graphic indicate that the cards are held in the player's hand in a first person view. Each card in the hand has its content facing the player. The back of the cards point forwards toward the opposing players, with the same designs as in graphic 3.1.2. The text on both sides of the cards are placed in the same, but

opposing position on the card to make it harder to read opposing players cards.

The rule card graphic has remained unchanged, but it is thought that the text content should point towards the players at all times, so that each player can read and re-read whenever they need. However, the specific wording of this card will be described at a later stage in this thesis. The sector card bas been placed shows elder care, this is the domain of which the players will invent solutions and discuss potential cases. As the sector card is placed, a player will assume the role of a potential investor seeking a product in this sector.



The images above shown how each player makes their first move. The red card indicates the card was placed by an opposing player to the first person view. As each card is placed, the players will give a short explanation how the technology will be used in its sector and how it will be beneficial to certain stakeholders.



The last set of images show how each player gives their opponent a weakness. As the player places the card, they have to explain how this weakness could cause an issue with its application and its potential consequences towards a potential stakeholder or the company itself. Following both sides giving their critiques, the players might get the chance to explain how the issues could get resolved or alleviated. Before lastly the third party will choose which invention they find the best.

Following the third party's choice of best technology, the winning player will receive the sector card, and it will count as a point towards a win. Over the following rounds of the game the players will collect more sector cards until they are the first to reach a set number.

3.1.3 Concluded on two games

In the end, the team ended up with two separate ideas, both with their own strengths and weaknesses. The team assessed the two games, and believed that only the single-player game seemed to require much effort in actually creating the prototype, as it would require either an actually functional digital prototype, or a complicated "dungeon-master" system to play-test. The card game on the other hand seemed to be comparatively simplistic, only requiring some card text brainstorming and printing these out on paper for simple play-testing. The team considered the workload each project would require, and concluded that it would be possible to continue with both. The team decided on doing a consideration at the beginning of each iterative step in the prototyping process whether to continue with both concepts or not.

Something that became obvious to the team was the difficulty to take every aspect of ethical skills into consideration when making a single game. A solution would be to make one enormous game with many different smaller aspects, but this seemed insurmountable for the team's schedule and manpower. By using the approach of having two smaller games, the team can potentially provide a more varied and engaging learning experience to the players without having the games require any form of integration with each other. It also means if one of the games seems to have too many issues to consider further development, the team can instead focus all efforts on the remaining one.

The two games lets the team approach ethical critical thinking skills from different angles and perspectives. The single player experience can offer a more immersive and introspective experience, which the team already has discussed can improve ethical learning outcome. On the other hand, the card game can offer a more interactive and social experience, using negotiation and persuasion.

The team thought the games helped practice ethical decision-making in different enough ways that the results of any user tests could create some interesting comparisons and contrasts. The single player game could be speculated to practice decision-making skills with a comprehensive set of competing interests using a simulated workplace environment, while the card game could help hone the players' communication and negotiation skills. Responding to criticism from other players could also be thought to add a different aspect that would be missing in the single player experience.

Lastly, this gives the team the ability to do a more robust evaluation of the effectiveness of the use of games in ethics education for computer science students. The team can compare learning outcomes and feedback from both games, which can give a more nuanced understanding of the strengths and weaknesses of each format and how they contribute to the development of ethical critical thinking skills.

Of course, there are downsides. The added time and resource constraints of making two games may prove too much, which will make the prototypes suffer in comparison to the team only made one. It might be difficult to compare the two games and what is learnt, and there might be bias in what games players already like. These are things that the team would have to be weary of during the project, but the team felt the merits of having two games outweighed the downsides.

Chapter 4

Ethical cases

This chapter will briefly describe the selection of ethical cases used in the prototypes and describe the background literature behind each specific case. The main contribution of this project is not within either ethics itself or storytelling, which is why this chapter will refer to a few previous works. This chapter is however relevant to the thesis due to the documents discussed here being the basis for the prototypes developed in this thesis.

4.1 Cases

Due to the game prototypes focusing on ethical decision-making as a potential aspect of working as a software engineer, the ethical cases presented in the game will represent hypothetical issues that may arise in a workplace. The game prototypes are set in fictional private sector workplaces and will present ethical issues through fictional cases based on issues that could manifest in a real workplace.

The cases described in this chapter will be anchored in The Code. Some of the cases will be borrowed indirectly from the fictional case studies described by the ACM in The Code. Others will be inspired by the code, but based in other literature. This is done to pad out the games with a variety of potential ethical cases. The ethical issues considered relevant for this project revolve around the development and application of information technology. This means that ethical issues surrounding topics like workplace environment, such as in case study 4 will not be considered relevant in this project (Computing Machinery 2018 pp 18). Due to the nature of Consultant Tycoon as a more narrative driven game, the cases will be represented more directly in ethical dilemmas presented in a prototype of Consultant Tycoon, compared to Startupsuperfight. The cases could however be reduced and used to create similar weakness cards in Startupsuperfight.

4.1.1 Malware disruption

In The Code, case study 1 presents a fictional case where a company providing web hosting services refuses to interfere with illicit activity hosted on their infrastructure. A team of experts is assembled to create a piece of malware that will disrupt the illegal services hosted on the company's infrastructure. The case presents a conflict between company policy and the code's principle of avoiding harm as described in The Code. Additionally, the case discusses how a team of experts would balance their goal of disrupting criminal activity while avoiding harming other services hosted on the infrastructure (Computing Machinery 2018 pp 14). The real life counterpart of case study 1 is the shutdown of the web hosting service McColo in 2008. This incident involved the internet service provider of McColo severing their connection to the internet, shutting down several botnets that were dependent on McColo.

4.1.2 Linking public data sets

Data sets could be problematic to open source, even after having been anonymised. This is mainly problematic because the anonymised datasets might be possible to combine with other publicly available datasets that might contain identifiable information. This is the main issue in case study 2 in the booklet. The issue of wanting to share information and worry about privacy issues is relevant to computer science students as both potential researchers and technologists, this case is therefore thought to be especially relevant.

4.1.3 Risk analysis

Case study 3 in The Code presents a situation where a medical technology company have to handle potential risks associated with one of their products. As a measure, the company opened a bug bounty programme to find potential new weaknesses. During the bug hunt, a vulnerability in the device was discovered. Due to the low capability of the device, it was decided that the risk was low enough for the device to go into production.

4.1.4 Green optimisation

Recent work has found that the ICT sector has systematically underestimated their carbon footprints, by some estimations by a margin of 25%. Part of these emissions lie in the increased need of increased infrastructure when traffic increases, which releases emissions. While traffic and ICT related emissions are not entirely proportional, they share a historical pattern (Freitag et al. 2020). Tools such as Beacon (n.d.) have been developed to estimate potential carbon emissions, using the file size of websites to estimate environmental costs. Concern for the environment is part of

the first of the general ethical principles of the code, making this issue relevant for this thesis (Computing Machinery 2018 pp.4).

4.1.5 Screen reader compatibility

Accessibility is an important part of the design and implementation of digital tools. Due to the reliance on visual methods of communication, one could consider the challenge of accessibility for visually impaired individuals as an especially interesting challenge. These challenges are also represented in The code, under the General Ethical Principles in point 1.4.

4.2 Future cases

To ensure the games' utility for use in education, the games will be developed with potential expandability in mind. This was done as new technology and regulations emerge, the different types of ethical issues may manifest differently. The team reasoned that the prototype might serve more utility long term if it is developed with consideration of the ever-changing nature of the technology sector and the associated legal regulation. This expandability is created in StartupSuperfight by providing a script for generating new card decks. The card generator will gather data from a JSON file, which can be modified or replaced to change the ethical cases the players will be able to explore and reflect on. In the video game, modifiability was thought to be difficult to implement directly into the game, however the game was open sourced and necessary instructions to modify the ethical cases were provided.

Chapter 5

First iteration

Starting our first iteration, we wanted to begin with making usable prototypes for play testing and to give our expert interviewees a clearer picture of the concepts. This involves a playable gameplay-loop in Unity for our business simulator and a set of cards for the card game.

5.1 Business simulator

5.1.1 Design process

In developing a game that simulates the management of a company, several design decisions were made in order to create an engaging and user-friendly experience. The game consists of cards that represent various aspects of the company, such as jobs, events, and employees. This was meant to simplify the interface, while keeping to a boardgame-esque aesthetic. Initially, the gameplay loop was designed to be turn-based, with a specific order in which cards were drawn and a "round" representing a day. Each employee would complete a certain amount of work per day, and if the total workload for a job was exceeded, the job would end and the company would receive payment.

However, in order to better fit the genre and create a sense of urgency, a time-based system was implemented. This system allows the player to control the speed at which they complete jobs and gain money, as well as the frequency of events that occur. Under the new system, employees now complete a set amount of work per hour and are only active during work hours (8am-4pm), receiving payment every day. Events, which were originally a separate deck of cards, are now integrated into the workday, appearing randomly during work hours.

To accommodate this shift to a time-based system, several changes were made to the game interface. A clock was added to the interface, replacing the CEO window, allowing the player to see the time and adjust the speed of time. The update deck was also removed to simplify visuals during development, and sliders were also added to the employee and workload areas, allowing for more cards than could fit on the

screen.

Overall, these changes were made in order to create a more engaging and user-friendly experience for the player. By implementing a time-based system and integrating events into the workday, the game creates a greater sense of urgency and allows the player greater control over the pace of the game. The interface changes also help to simplify the visuals and make the game easier to navigate.

5.1.2 Development process

With limited time and resources for development and user testing, the team focused on making a working prototype with a working gameplay-loop and simple mechanics. The initial prototype therefore lacked many of the features originally planned.

The CEO was not implemented, as this functionality would be complex and deemed less important to the base functionality of the game. His intended use case of providing insight to the player and as a tutorial were things that the team had to de-prioritize. Additionally, the CEO used many of the different mechanics that also were not implemented as cornerstones for his system. This sadly removes one of the more direct ways for the game to communicate information to the player, and meant that the game would be harder for players to understand and would mean one less avenue to provide the player with educational information.

The ethical complexity was also de-prioritized, and the team instead decided to go with a simpler system that judged the player's decisions based on loosely estimated societal favour. In practice, this meant to include a degree of "selflessness" to every job contract, which would over time add up to a total "selflessness" factor for the company. Additionally, the different events that appear during a job has 3 separate possible responses, each with an associated degree of "selflessness" which contributes to the same "selflessness" total. The team believes that while this system is fine for prototype purposes, it is not adequate for genuine ethical education of students. Firstly, the team is not a source of ethical correctness, and the game would ideally attempt to avoid any enforcement of biased ethical teachings whenever possible. Secondly, simply labelling any choice with a "selflessness score" is far from adequate of a denominator for what makes an action ethical.

The last major missing mechanic of the game is outside events. The original design considered some scenarios of outside influence, like government bodies or other authority figures awarding or punishing certain behaviour, or social media events with some level of impact. This was left out mainly because the team believed more research would be required to confidently back up such mechanics. This change affects the educational potential of the prototype, as portraying the effects of the company on the world around it, and the dynamic world on the company, is an important part of showing the player the consequences of their actions.

In Figure 5.1.2, we can see the prototype with the new design changes. A few employees have been assigned a job and are currently progressing, the recruits deck has just been pulled and is therefore on cooldown, and the player has selected a new

recruit and is given options to interact with it.

Figure 5.1: Screenshot from prototype, game in progress.

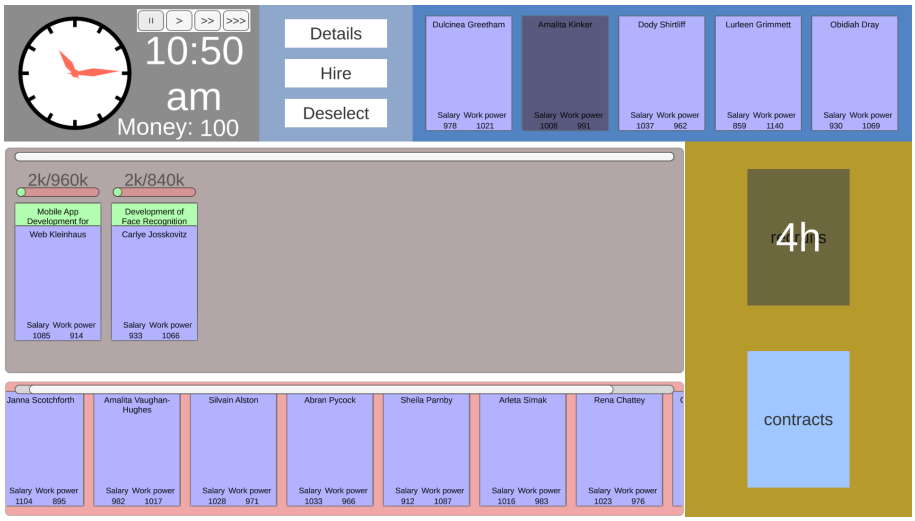
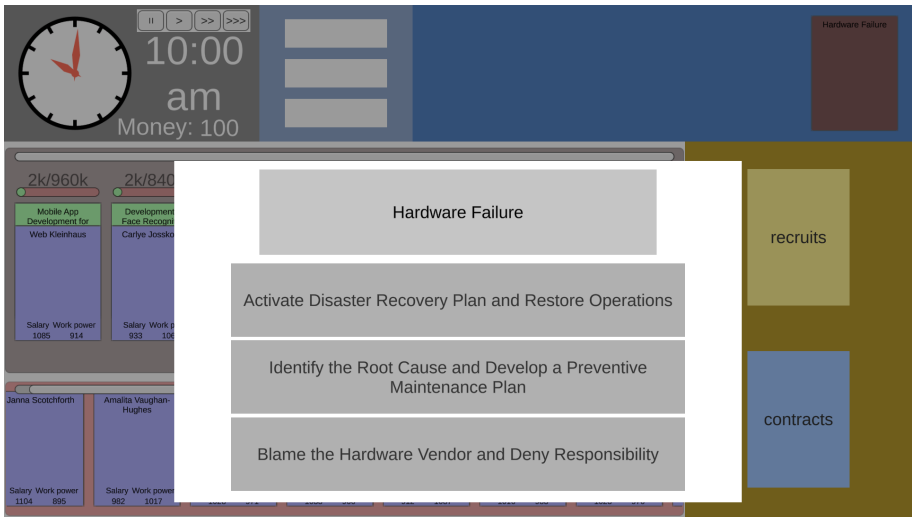


Figure 5.2: Screenshot from the prototype during an event. The player is given the choice between 3 solutions.



5.2 Card game

This section will describe the design choices made for the first iteration of the card game, and the development process of the prototype.

5.2.1 Design process

For the first iteration, the team focused on developing some general guidelines for what the cards should be and devising some simple lists for prototyping. Following

the original concept, there would need to be 3 decks, one for domains, one for technologies and one for weaknesses. Despite this, the team decided that they would forego weaknesses this iteration, as it would be difficult to define seeing as they would have to fit most of the domains and technologies. When domains and technologies themselves are still under development with large likelihood of major change, trying to fit weaknesses onto them seemed to not be a good use of time.

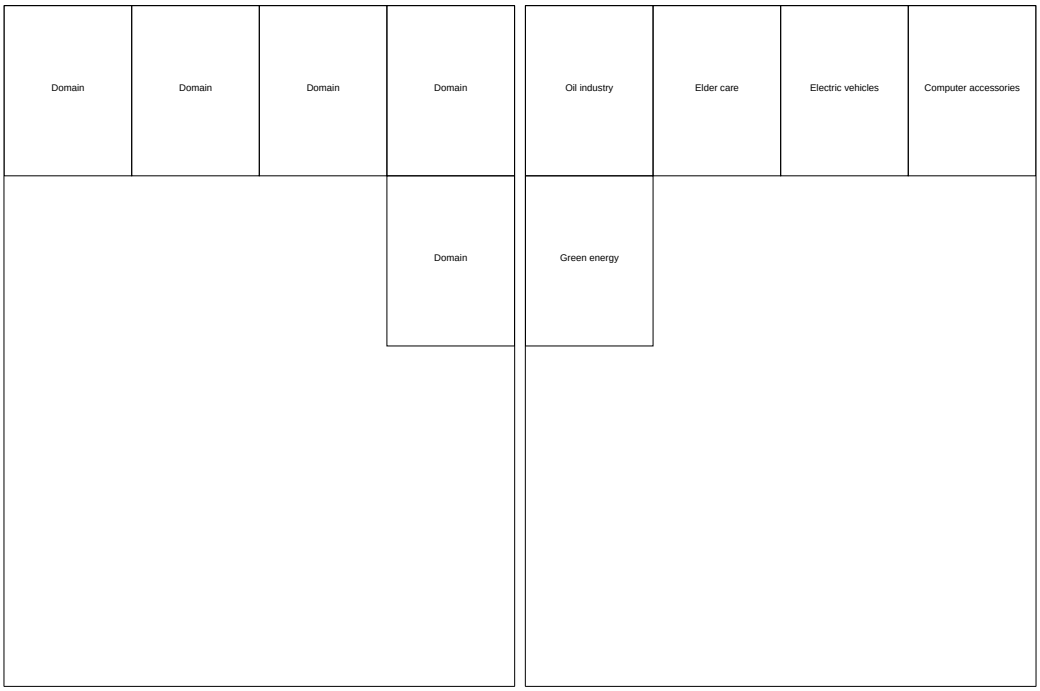
Starting off with the domain deck, the team wanted to keep it simple and decided to base industries on the "Major industries" list on the Wikipedia page "Outline of industry" Wikipedia n.d. For some, the team picked the overarching industry like "Agriculture", and for others the team decided to use the sub-industries like "Aerospace". The team loosely picked out the industries they felt seemed like most people would be at least somewhat familiar with and would fit well for pitching IT startups. The following is the final list devised: Agriculture, Aerospace, Construction, Defence/Military, Energy, Textile, Fashion, Education, Finance, Healthcare, Sports, Transport.

With the technologies deck, the team would need to personally brainstorm the cards, as they could not find one single fitting list on the internet. For simplicity, the team decided that technologies in the first iteration would simply be loosely defined areas of technology within IT, like "Augmented reality" and "Machine learning". The following is the final list devised:Internet of things, Robotics, Augmented reality, Quantum computing, Nanotechnology, Cloud computing, Machine learning, Printing, Computer security, Computer vision, Natural language processing, Biometrics, Distributed computing, Virtual reality. The team was not certain if this would be a good way to define technologies, as they might seem too vague for the players to come up with solutions. Still, more specific technologies would perhaps be difficult to apply to all the different domains, so this was deemed satisfactory for the first iteration of the prototype.

5.2.2 Development process

To create the actual cards for this iteration, a python script was created to take a JSON list object and automatically make a PDF for easy printing. The script would make a PDF meant for two-sided printing, where it would first make a page with the card contents on a grid, then follow with a mirrored page where the content was replaced with the name of the deck, for example "domain" or "technology". The script was made in hopes that it would speed up prototyping, and could possibly be included as a tool with the project. The initial script can be seen as appendix B.

Figure 5.3: Here is an example of a PDF created by the python script



5.3 Evaluation

5.3.1 Method

To evaluate the initial concepts the team developed in the concept creation phase, they arranged semi-structured interviews with relevant experts and user groups. Interviews as a methodology was chosen to allow the experts and representatives to give qualitative data and a broader range of thoughts and impressions of our initial concepts.

To evaluate the game concepts, the team decided to interview a wide spectre of potentially interested actors to allow different perspectives to shape the initial game concept. After creating a series of storyboards to communicate the game concepts, the team contacted the following experts; a computer science professor, two game experts and an ethics professor. Due to how different the field of expertise is between the interviewees, the team decided to interview the different domain experts separately.

The interviews were conducted physically colocated, with audio recordings and active note-taking by one of the team members. The recordings were saved directly on NTNUs servers through the use of Microsoft Word using NTNUs Office 365 implementation. The use of audio recording and data storage was approved by NSD in advance of the interviews. As part of this application, a consent form and an initial interview guide were provided to NSD. The same consent form was provided to and signed by every participant. The original interview guides in the application were

very brief and unspecific, leading the team to make them more specific before the interviews. The overview of these updated documents and concept forms can be seen in table 5.1.

Computer science professor	E	L
Game expert	G	K
Ethics professor	E	M

Table 5.1: Experts with consent forms and interview guides

Before recording began, each interviewee was provided with a consent form and asked if they would consent to participate in the project.

5.3.2 Experts

Due to the multiple disciplines being considered relevant for this project, the team decided to ask experts from multiple fields to contribute to the project with their own perspectives, experiences and expertise. A full overview of the experts and representatives and their contributions can be seen in table 5.2

Firstly, the team wanted to interview a computer science professor within a field where professional activity can be clearly be mapped to ethical responsibilities as described in The Code. For this, the team chose to focus on professors within applied computing, specifically Human-computer interaction and welfare technology. This decision was made to allow the games prototypes to explore ethical issues surrounding the application of a wide array of technologies.

The ethics professor has many years of experience teaching ethics courses to technology and engineering students. They are a researcher in their field and have provided their expertise to several projects. The professor focuses on ethics within the context of engineering and technology.

Unlike the previously discussed experts, the game experts were not academics in the field, but expert by way of professional and hobby experience. The game experts were recruited by contacting a small game development studio, where they serve as both game designers and developers. The team chose to involve developers of commercial entertainment games as this was thought to be a particularly relevant perspective in regard to the team's game design approach as described in chapter 3.

Interviewee	Contribution
Computer science professor	Pedagogical perspective. Give feedback regarding the requirements of a prototype and insight into the deployment of learning activities.
Game expert	To get feedback regarding game flow, game design process and evaluation.
Ethics professor	Will provide the perspective of an experienced professor within the field of applied ethics. Additionally, the perspective of someone who has experience with teaching ethics to engineering and technology students.

Table 5.2: interviewees and their contribution

5.3.3 Results

The descriptions and reflections surrounding each of the interviews are included in the respective iteration during which they were conducted. All the interviews were held in Norwegian, but described in English to ensure consistency with the rest of the project. The interviewees are also described with the singular they pronoun, as the team wanted to let go of as much personal data as possible, as long as it is not directly relevant to the project.

5.3.4 Interview with computer science professor

This was the first interview conducted. The professor was introduced to the two game concepts and asked about his opinions and suggestions, as well as his thoughts surrounding the ethical education of computer science students.

Summary

This will contain a summarization of the dialogue between the team and the professor. As it was an unstructured interview, it will be presented as a summarization of different conversational topics, loosely divided into paragraphs.

The professor was interested in what settings the games would be used. They said that things that focus more on discussion has more educational value, and that he didn't have much trust in a single-player game like proposed would be similarly valuable. From their perspective, it would be more valuable to read up on the information meant to be presented instead of having it presented it in such a game format. They believe such games often lose sight of the intended goal by being overly complex and has difficulty keeping everything in line with the intended learning outcome. The card game on the other hand is purely in favour of discussion surrounding topics and therefore fits more analogue with intended learning outcome. Cards are a well known metaphor that is easy to grasp and manipulate to fit the

course's needs, while the video game's complexity makes it a heavy investment with a lower likelihood of a good return on learning. There are also many courses where students are divided into groups, and this facilitates well for using the card game in discussions. Some of these courses are especially well suited, like courses based on product creation in groups.

The professor had not used games in their lessons outside of Kahoot for summarization, and is so far not convinced there is much value in using games in his courses. Most professors might not have used games in an educational setting, or at all for that matter. Many aspects that the team might take for granted might therefore be hard to understand and utilize. Unlike the card game, which has more of a direct analogue to practical exercise, the video game might be a bit too abstract to understand for some.

When it comes to the game content itself, the professor says that it might be advantageous to be more specific in what is asked of the players. The professor explains that ethical questions are often context-specific, so having a genuine discussion and learning outcome might be difficult without it.

When discussing the implementation of the card game into courses. Their first impression was that it wasn't necessarily correct to mould decks to fit courses. Rather, it would make sense to make some decks to generic domains, and a professor could pick a few that would fit the situation. The idea of using "wildcards", blank cards that the professor could write on with erasable pen to make cards of their own, might also be a good idea. The most important aspect of the game for the professor would have to be that it was easy to use and understand, and that it facilitates discussion, not "right" or "wrong". They were positive to the idea of having the rules fit on one or two sides of a card.

Regarding ethics education, the professor could not seem to recall much direct education on ethics outside EXPHIL. They believe that it could be beneficial with a bigger focus on the ethical education of computer science students, as a part of the obligatory curriculum. Simultaneously, students often do not understand the point behind the ethical courses like EXPHIL. While some things learnt in those courses might show up later in life, the courses often might seem too abstract to see the real value of the lessons. Students' motivation to work on the course is possibly diminished because of how far removed most of the concepts seem to be from computer science. As the university has few different EXPHIL courses, each with large amounts of students, this might make the courses too generic as to fit the diverse collection of studies attending each course.

The professor explained that something that is not completely clear is how much ethics education any one student receives. Several subjects have ethics embedded in the curriculum without necessarily directly pointing it out. Several courses will teach students to take ethical considerations, identify stakeholders and try to view things from different perspectives to achieve a better result, as this is the industry standard when designing systems for an end user. In fact, using the word "ethics" to describe a section of a course might instead make the students less interested, especially considering how courses on ethics alone can be perceived as "dry".

Still, while there might be more ethical education than first assumed, the professor continues with saying that ethics in computer science has become more important over the years. Technology is improving at an alarming rate, and laws are slowly lagging behind, trying to catch up with all the new domains appearing seemingly overnight. Everything has some level of computer science involved, and the progress is often faster than the discussion surrounding it. They end the thread by saying that perhaps the best solution would be to increase the prevalence of ethical discussion in every course, rather than a couple specific ethics courses.

Reflection

This will be a summary of reflections made based on the interview.

Taking the impressions of the professor into consideration, the team believed that perhaps the video game did not have the same potential as the card game. It was difficult to come up with a good way of integrating the game into a course, and prototyping for the idea proved lengthy. Additionally, the usefulness of the game in a classroom setting seemed questionable, as it would become a huge undertaking to modify the game to fit a course's specific curriculum. Lastly, it was obvious that video games were not something all professors knowledgeable about, and therefore it might not be easy to convince them to use one in their course. More work might therefore be required to make the game approachable. While it was possible to discard the video game idea, the team decided to instead postpone further development while they conducted a few more interviews, hoping they perhaps instead got some feedback that would let them instead improve the idea to make it more viable.

In contrast, the professor seemed optimistic about the card game. As they said, the cards may be too generic. Leaving it up to something as nebulous as a whole industry might leave the players with little to work off of. The lack of details and context might lower the immersion of the players, which as discussed in chapter 2 increases potential learning outcome and increases likelihood of making genuine ethical reflections.

Considering this fact, it might be a good idea to change from domains to personas. If instead of having a deck of domains with industry cards, the game had individual decks for specific domains with persona cards, the players could be provided with much-needed context, and professors could pick which ones seemed relevant to their course. This would then potentially increase their immersion and engagement in the game, and subsequently improve learning outcome. This would possibly require a redesign of the game system and cards, and the team would have to develop a system for creating these personas. They would need to be backed by genuine problems, and create a sense of responsibility for the players to make the correct decisions.

How technologies and weaknesses would change based on this shift in design is unclear. It is not certain whether technologies should also then be tailored to the domains or be generic. Having the cards be tailored to help the players in concept creation could possibly strangle creativity and make the game more of an exercise in finding the pre-determined correct technology combinations and weaknesses. On the

other hand, it could give the players context and knowledge about real life scenarios and let them discuss around them in a safe environment. If instead the game had more generic cards, it could potentially lead to more creative solutions that have not been previously explored as deeply, and again would provide a safe environment to attack the problem from perhaps more unconventional perspectives. However, generic cards could also leave the players with too little context on the issue, which might lead to less meaningful discussions and potentially a worse learning outcome. Still, it is possible that having a more context heavy persona could give the players enough to work off of to make some decent reflections on the topic.

One idea might be to combine the two and instead have separate technology decks for more generic technology and more specific technology. These decks could either be shuffled together to give a varied pool for the players to choose from, or kept separate and used in different situations. Perhaps the more detailed deck could be used in early sessions to give the players more exposure to the domain, its issues and possible solutions, and the more generic deck could be used later on to facilitate more varied points of view and discussion

Lastly, the idea of wildcards might be a good addition to let professors add their own cards to fit their use. Making it more modifiable for the professors is definitely a point to expand on later.

The team decided to keep the cards generic for now, and to gather more opinions on possible solutions. As the video game was put on hold, most of the time from now on would be focused on the card game.

Regarding ethics education, the professor seemed to mostly confirm what the team had previously believed. Students do not receive much in terms of direct ethics education, outside EXPHIL, which to many seems too generic to be engaging. The professor did however remind us about the ethical teachings indirectly taught through many courses. Still, they agreed that the current education might not be enough, especially considering the pace at which technology now advances.

5.3.5 Interview with ethics professor

The ethics professor was the second person to provide their feedback on the game concepts, this time with an additional emphasis on the perspective on applied ethics implemented in the game concepts.

Summary of interview

This will contain a summarization of the dialogue between the team and the professor. As it was an unstructured interview, it will be presented as a summarization of different conversational topics, loosely divided into paragraphs.

The professor was first asked what they meant was the most important thing to convey to computer science students. Remarking that the question was complex,

they described how difficult it is to tell what a student will benefit the most from learning, and that it is important to know what questions to ask and what knowledge the students should be left with. They then answered "making assumptions about the recipient's needs" as something important to convey. They went on to explain that it is hard to know if you are properly fulfilling the studets's needs, and that doing so required a large and personal process. It is therefore important to teach the students the right questions, which will point them in the right direction. They also added that it is important to teach students that ethics is something fundamental to computer science, not a separate field of knowledge, and that students should feel a need to take responsibility for the ethics in their daily work.

When asked if they could see an ethics module working as a part of an IT course, they responded that it depends. Ethics is often taught without explicitly stating that it is ethics. It depends on what questions lead to such a module being required. What is important is what problem the module is meant to solve. The team says that the point of these games would mostly be "training", practical exercises to build experience. The professor says that one obviously gets better at things they train in, and that this would very much be analogue to what professors attempt to teach in their classes.

Moving on to the video game, the professor expressed concern that an educator might find it difficult to know if they can use such a complex tool properly. They wonder how much of a sense of ownership the professors would have, and how much time would have to be spent on getting to know the system before being able to use it. They add that they found a digital single player experience interesting as it could allow students to explore an issue in their own pace, and that it could be useful in creating engagement from the students as something fun to increase exposure to the topics in a different setting than the classroom. Wile these aspects were found interesting, they also expressed concern that this would add another degree of complexity when deciding to apply this activity to a course. They expressed worry that the complexity and dynamics of such a tool might unknowingly take something away from the intentioned learning outcomes.

The team then introduced the card game concept. They found it to be interesting, especially how it lets you see different viewpoints regarding a topic. They expressed that they enjoy how it combines the implementation of technologies with potential ethical issues and technical weaknesses with consequences for stakeholders. Another aspect of the game the professor found interesting is how big of a role communication plays in the gameplay. They thought that it could also be beneficial to the players to practice presenting a serious argument, especially when the argument is rooted in their field of study.

The professor meant that it was important to know what to put focus on. The game seemed good for facilitating current burning issues, and creating knowledge amongst the players. They said that even if the cards do not allow the students full freedom, thinking "this should be a card" is itself a learning opportunity. They pointed out that it was hard to know when you had a good case. It is important to find real life cases that actually occur, which might sometimes be hard to find publicly. They go on to say that role playing games can help show different perspectives and

immerse someone in the products they are in the process of making, giving them insight they might not have got otherwise. Exposure to discussion and seeing how hard it is to argue for and against something and making assessments is a good learning opportunity. You learn a lot by asking yourself even simple questions that one perhaps usually answers with intuition, like "why is plagiarism wrong?", helping you understand the issue better.

They finish off with re-iterating how important it is to know what the students are meant to be left with. Often one can experience the activity as fun, but end up wondering if you even learnt something from the discussion. The game might potentially be very educational, but it is hard to say for certain. Even so, just by creating engagement among the students, the game has potential value.

Reflection

This will be a summary of reflections made based on the interview.

The professor points out that it is difficult to properly take the end user's values into consideration when designing a product. This is the essence of what the team wants the card game to facilitate. It's easy to make assumptions, and sometimes one can be blinded by only focusing on a certain category of requirements. Only focusing on what the end user needs, physically, might leave out important factors like their personal values and concerns. Therefore, the team want the players to see the issue from several perspectives, especially the one of the end users. The team wants the players to take into consideration aspects like where materials are sourced or privacy concerns. When asking an end user about what they want, it is important to figure out the true intent behind their needs. The process of figuring out the end user's need is a long and tedious process, and needs a lot of experience and practice, precisely what the team wants to provide to the students. Taking this into consideration when designing the games, the intent of your different stakeholders must hold importance in the result. If the solution does not follow the spirit of the assignment, the end user will be dissatisfied.

Fundamental in this interview seemed to be "knowing the right questions". As the team learnt in the previous interview, it is important to remind computer scientists that things like ethics isn't just a separate discipline in academia, but an integral part of everything they do, and that they should feel responsibility for the ethical aspects of their daily life. Computer science students are often taught ethics, even if it is not specified. Rarely will you be told "these aspects are those of ethical concern", but rather it will naturally be a part of each and every subject. How much each subject chooses to weigh in on the ethical aspects, however, is individual. It is however hard to specifically pinpoint how or why one would improve the ethical education for computer scientists. What specific questions ultimately lead to the conclusion that such modules or changes are needed? "Are computer scientists equipped to handle ethical considerations in their daily work?" might conclude that more education might be needed, but it does not specifically imply that such an ethical module is the answer. "How do you make computer science students engaged in learning practical ethical skills?" might conclude that gaming is a good arena to engage the

students, but doesn't answer how the skills themselves are taught. "How do you make a game that effectively teaches computer science students practical ethical skills" would perhaps be the final question that justifies at least the masters project itself.

Fitting with the computer science professor's viewpoint, the ethics professor felt that it could be hard for professors to find value in the video game. Considering the game in a practical sense, it might indeed be difficult for a professor to find the potential learning outcome to be outweighed by the effort required to adjust the game for their course. Additionally, the game must be designed with the needs of the end user in mind. While being modular can make the game useable in many different contexts, it can also increase the burden on whoever decides to use it.

The professor did however see some value in a single player video game, which game the team some hope in salvaging the idea further down the line. One thing the team had not considered before now, was the inherent value in just including something fun in the course, like video games and card games. The positive associations could increase engagement enough to be of value, and at least bring attention to some topics, even if they do not thoroughly educate on them. This could spark ideas and thought processes that will help them better understand things on their own. It can also indirectly make them more interested in the course simply by making it more fun just by being part of it. Still, it is important to at least attempt to keep the design on track with the original intent. The games should still be designed to educate the students.

The team decided to keep going with the same strategy from earlier and focus on the card game, as they still felt that did not have enough to work with in regard to fixing the video game concept to work properly.

5.3.6 Interview with game experts

The game experts were the last experts to provide feedback to the game concepts.

Summary of interview

The conversation started regarding games used in an educational setting. They distinguished between things made for fulfilling a want of the end user, and things that end up forced onto them. Educational games can often feel like the latter, as they are made for education first and foremost and often forget to be fun. They added that you need to ask yourself if it needed to be a game in the first place. They take a lot of work to make, and you should therefore have a good reason to make one.

They gave some general tips for making such games work, like how they often fail because they include too much of the nitty-gritty. Instead, it could be a good idea to make things more abstract and streamlined, focusing on teaching the concepts and ideas instead of a hyper detailed experience. Of course, this can become a

problem as well, as abstraction can also take away learning potential. Games like Kerbal space program are good for learning basics, concepts and get people excited about rocket science and space travel. Simultaneously, it would not be very useful in teaching the things you actually need to know to build a rocket.

When asked how they usually come up with game ideas, and how to make games fun, they say that user tests are very valuable. Still, they believe it is very intuition heavy, and that they usually rely on their own sense of what makes something fun. It helps to have a clear goal or fantasy, one that people in general wants to partake in.

The interview then went over the game concepts, starting with the card game. They expressed intrigue, saying it seemed like a good brainstorming tool. They also said that the technologies could possibly be both too generic and too specific, depending on who writes them, for the players to come up with any genuine solutions without being railroaded into pre-determined solutions. Weaknesses would also have a similar problem. They agreed that the idea of having a generic deck and specific deck for technologies and weaknesses could be a possible solution.

They agreed with the idea of having a generic deck and specific deck for technologies and weaknesses. They were unsure if the value would be in the deck generation tools, as any random person might struggle with making good cards. The inherent value might be more in pre-made decks, shown to make for good discussion. They were positive to specific personas, saying it helped them imagine the people affected by the technologies more directly.

They said that it is important that you feel like you're actually learning, but that fun is also perhaps the most important factor. It can be a good idea to use the opportunity to expose the players to some weird technologies and maybe futuristic things, letting them have some fun with the concepts.

Something they thought of was introducing different personas somehow, as weaknesses or some other way. When you design a technology, there are often several people affected by it. If you design some elder-care welfare technology, it's important to take nurses or family members into consideration. You also have to take into consideration that the customer is not always the end-user. The people living in an elder-care facility are not the ones who make decisions about what equipment to purchase, and it's most likely their nurses who will have to deal with it.

Lastly, they finish saying that they like how the game seems very simple and easy to pick up, with very little setup. They could easily imagine the game in its finished state, and liked how it facilitated discussion.

Moving onto the video game, they liked the idea of tackling ethical issues from the viewpoint of a corporation, as they often have to make less ethical decisions. Even if actual people work there, they function more like large machines without emotion, almost like a proto-AI.

They pointed to the part where you chose solutions to issues as the main part of the game, and the one with the most to give. They had initially imagined the game was meant to be a discussion based game within a group, like the card game, where the

timer stopped during an event and let the players discuss for a certain amount of time to avoid players trying to speed through the game. An idea they pitched was the different players having different roles, where they each had objectives in terms of what type of outcome they wanted for the company, and had to discuss without revealing their role.

When discussing how the ethical decisions would impact the game, namely how stats were counted in the background and affected gameplay, the game experts noted that it would probably be better if these kinds of things were shown to the players. In a realistic setting, business owners would know somewhat how a decision could affect the company, and hiding the stats might make it hard to make a decision. Giving the students information on the situation could help improve the quality of the discussion. They also noted that if such stats were hidden in the background, the discussion might quickly steer towards the background mechanics to optimize their choices, rather than ethical discussion.

An important factor is also to avoid portraying one answer as the correct one, as it will undermine the discussion. They had experience with previous similar projects where this was a glaring issue. It always seemed like there was a perfect answer and the rest was obviously presented as bad. The different choices do not have to all be equal in all views, but rather cater to different value-sets. Because of this, they were critical of the current "selflessness" system, as it seemed too black and white to be useful in an ethical discussion.

An idea proposed by the game experts was to implement a system where the players choose between what choice they believed was most ethical, but then also choose one they believed the company should actually make to survive. Doing this could help show players the thought process some companies went through when they made a choice that seems unethical at first glance.

They recommended to look into a game called terraforming Mars, as it is based on the concept of competitive cooperation, similar to any real world market. As a player, you are meant to strive to come up on top, but at the same time you will fail if the planet itself fails to be terraformed. Therefore, a healthy planet and the success of the other businesses is necessary, as long as you are even more successful. A similar game called "Architects of the west kingdom" was mentioned for having such mechanics as well, especially mechanics that would give players access to different resources depending on what choices they made previously. Different things could affect the dice rolls as well, depending on how good of a PR department you have or your CEO. Your choices could for example open access to hiring such people that could get you more easily out of social media scandals, or give you information about what type of projects the EU will favour in future. Another mechanic could be that while the groups are playing, at some random point, possibly affected by the different choices taken so far, an event could pop up and affect all the groups from then on. This could improve engagement and work as a powerful tool.

They commented that these additions could make the game a bit complex for something to be learned and enjoyed in the context of a classroom lecture. You could go back to the idea of a single-player at-home game, but they saw how it started to reach similar issues as the original video game idea had. They noted that since

the goal is to educate computer scientist students specifically, they might be more inclined to enjoy a more complex game as homework than other students. The game experts recommended going forward with the group based voting video game, and test it as a tabletop game to ensure that the game is simplified enough to where new players can understand the mechanics of the game.

Something they felt was a really powerful aspect of the game concept, is that it could be possibly played in a huge class with several hundred students. This means every play through could potentially have very interesting statistics with a relatively big dataset.

Reflection

The team found that this interview was very different from the previous two. It focused more directly on game mechanics and allowed us to brainstorm openly with experienced game developers of similar backgrounds to ourselves. Most importantly, it meant that the feedback given on the video game was more in depth, which gave us more to work with on precisely how to improve it. In the previous interviews, the conversation surrounding the video game was mostly focused on its value as a tool in education, not specific mechanics or what needed to be improved specifically. This made working on the concept hard, as there was no concrete direction to work towards, no list of things to improve. Another aspect was the general attitude towards the idea. The professors seemed uncertain as to the educational value a video game could have in a university course, outside of perhaps increasing engagement in the course slightly. These two factors had until now made the team question the value of the concept, and made the team de-prioritize the idea for the time being. As for this interview, the game developers seemed positive to the concept of educational games. Additionally, the team was given specific constructive criticism on each mechanic of the game, and examples of different games to look for inspiration from. The interview even sparked a completely new design direction for the game, namely the multiplayer discussion based game. This interview helped the team brainstorm ways to salvage the idea into something that the team believes the previously interviewed professors also could have seen the potential in. There were many different mechanics proposed in the interview that would be fun additions to the game, which the team will take into consideration for the next iteration. However, as the game developers mentioned, it might be a good idea to simplify in the beginning, so it is likely that most of the mechanics will not be added or simplified.

Important points made in the interview, were making the game fulfilling for the end user, and avoiding nitty-gritty details that perhaps would add some realism but not necessarily facilitate learning. This contributes well to the development of the new video game, as the team will do away with the nitty-gritty of managing a company and instead focus purely on making the situational decisions by weighing the facts. The game will focus on retaining the details that give the player proper learning potential, without losing itself in unnecessary detail. In the end, it must be important for the game to be fun, and that the players feel like they learnt something.

The remarks on hidden statistics working in the background also seemed logical. In future versions of the video game, they should be kept shown. Keeping the discussion away from trying to figure out how the game works is important. It is also realistic that consultants would more or less know these things, and the game's intent is not to test one's competence in consulting. The idea of picking an ethical answer and an actual answer could also give some interesting insight.

There were also many interesting potential mechanics brought up when talking about other games that came to mind, especially games where the point is to come out on top but not completely sink your opponents because you need the "market" to survive. The mechanics related to following certain paths, accessing different resources and hiring employees with different effects were intriguing, and the team believes they could be interesting ways of increasing complexity and engagement in the students. However, outside of perhaps some classroom wide events based on the collective choices of the students in the middle of the game, these ideas seemed to move the game in a different direction. While the demographic is computer science students, and they therefore might enjoy a more complex game, it seems a bit out of scope for the current game if it was to be kept simple. Therefore, most of these ideas will not be included in the video game going forward.

What these mechanics and ideas could become, is another addition to the game collection, perhaps as a board game. This would be similar to the games mentioned in the interview, and focus on building your business and sabotage your opponents. A basic concept could have each player running a consultant business, with access to some basic resources like work power, public reputation and money. They would pull consultant job cards and spend work power to finish them, and would be dealt event cards based on dice rolls. Depending on their response to the events, they would gain or lose resources. They would be given opportunities to hire employees like CEOs, PR managers and HR managers that could give them buffs to resources gained from events or even access to completely new resources. The point of the game would be to win, but the learning objective would be to see how companies affect the surrounding industry with the choices they make every day. This game idea will most likely not be added as a fully fledged concept to the game collection, but perhaps become a part of future work.

Moving onto the card game, they confirmed the team's belief that it is very similar to a brainstorming tool for product design. It could be a good tool for airing potential solutions and problems a group wants to tackle with their product. It would help make the players aware of each other's thoughts in a safe setting, without forcing them to openly criticize each other's ideas in a normal brainstorming session. It would be like a team building exercise to get them used to debating ideas and give some inspiration, prior to an actual brainstorming session.

As mentioned in previous interviews, it's important to try to find a balance between specificity and playing room. It is clear that the team must make sure not to constrict players of the card game too much, but make sure to give them enough to work off of as well and to keep it educational. The interview reaffirmed that personas is a good solution for achieving a good balance of this. The developers seemed to agree that a general and specific deck is a good idea. As previously

mentioned, it might be a good idea to have several levels of specificity and ramp up the "difficulty" as the players get used to the game. The concept of several levels of specificity in technology and weakness cards must be explored further. The idea of having some futuristic cards and other more fantastical elements was also interesting, perhaps possible to be added in separate decks made to increase variety and in turn longevity of the game. This would play into the idea of balancing fun with education. An idea that must definitely be further explored is having some type of personas in the weakness cards, other people affected by the brainstormed products. It's important to think of several stakeholders, and weaknesses is a good avenue to explore this concept. In general, the game developers seemed very positive to the card game, similar to the professors, and the team believes therefore that they should move on to user trials after some minor changes.

As to the content generation hub, the game developers did not seem overly positive. The team believes this platform has potential, if nothing but as a hub for the rest of the current and potential future games. The team does however agree that the average professor would be unlikely to be able to quickly pick up the tool and create something useful for their course. Guidelines for users would help mitigate this, but regardless, the team believes that the platform's main value is in distribution of the games and to speed up prototyping.

Lastly, the team was intrigued by the point made by the game developers that a big class of students playing such games in a classroom setting could potentially give scientifically significant data. Games meant to be played by a class of anywhere between 100-300 or perhaps even thousands of students have the potential of producing datasets large enough for use in further academic study, and considering this, a future version of the video game could cater for research purposes. This will however not be an idea pursued in this project.

5.3.7 Discussion

This will be a summarization of our thoughts surrounding the evaluation and way forward for the concepts.

Startupsuperfight

The personas were well received and should be kept. Technologies should probably be split into generic and specific cards, and perhaps into normal and funny/futuristic cards. Weaknesses should also include references to different stakeholders as well. This game will be a discussion simulator, good for building confidence in a group to voice differences and defuse tension. It will be used both just for general discussion surrounding a subject, but using the content generator and generic cards it could easily be used as a brainstorming tool for group projects.

Digital game

Following the interview with the game experts, the team decided to make an alternative design for the entire game. This is also heavily grounded in the feedback from the professors. A single player game for at-home didn't seem to have much value in their eyes, and the team saw that it would be hard to convince professors to actually use it. The new version will be based on the existing ethical case screen. This design will be made to include more information regarding potential consequences of the player's decisions. The available decisions in the scenario are based on potentially conflicting perspectives on the ethical case being discussed, and will be based on The code (Computing Machinery 2018). The rest of the game will more or less be removed, and the game will fully facilitate a multiplayer classroom play style. In addition to this change, the team will also make new designs for the surrounding framework, as the players need ways to actually vote, and there needs to be an interface for the teacher to set up the game.

requirements for the next iteration

The games must reach a degree of specificity regarding how they treat ethical cases, such that the conversation that come up during play reach a greater depth in the domain. Preferably, the games will also be implemented with the possibility of anchoring them in real cases or relevant professional discussions, such that the players could explore some of these cases if they are found interesting.

Chapter 6

Second iteration

6.1 Business simulator

6.1.1 Design process

Following the interviews of the last iteration, it was clear that the original video game concept might not have accurately captured the goal for the concept, and might not fit properly into a classroom setting while accomplishing the established learning goals. Because of this, a new design was made based on the ideas brought up in the interview, albeit with some changes. This change in direction also led to a change in RQ1.2. Originally, the team wanted to explore how similar experiences with single player narratives could facilitate for post-game ethics discussion. But in this iteration, the concept was changed to become "How could collaboration be implemented into a game to facilitate for ethics education for computer science students".

Now, while many different interesting ideas surrounding the video game were proposed, the team does need to prioritize and simplify. To fulfil the base concept of the video game, the team believes the idea of having different roles and things like imposters trying to sabotage the company to be unnecessary. This complexity might be fun, but the team believes the learning potential is limited unless the idea is explored in more depth than this project's timeframe allows.

Based on the inspiration from the interview, the new game design involves groups of students connecting to a game session set up by the teacher, and the groups will then be shown different issues that can occur within the IT sector. As consultants for the companies that end up in these situations, the groups will be presented with details on the issue, and different ways to respond to the situation and related information. The students will also be shown some potential effects meant to represent what might happen based on their chosen response. They will be percentage chances of certain things happening as a result of the response chosen. This will work alongside the explanations of the responses as an educational aspect. The team believes this makes sense for the setting, as a consultant would know these things, and it would be

an opportunity for learning for the students and help the discussion along. Based on feedback, the team has concluded that it would be beneficial to display this information to the students, to avoid speculation and keep the discussion relevant to the ethical dilemmas.

The students will then be given time to discuss the different responses, and will ultimately be asked to vote anonymously for an answer. While the team liked the original idea of picking an ethical answer and an actual answer, the team instead chose to only keep the actual vote. The team came to find the distinction between the votes to be vague, as it was hard to differentiate between what made a choice ethical and what made it the preferred alternative. Perhaps it could be added in later, but did not seem necessary when trying to simplify the prototype.

An important factor that the team wanted to focus on is that the video game is meant to show what needs to be taken into consideration when making decisions in corporations. In addition, the team wanted to expose students to different ethical dilemmas that have been relevant in recent years, and show them some different angles of attack to solving the issues and give them food for thought. Additionally, team found in research (2, 4) and believe themselves that it is important to avoid a "correct" and "wrong" answer. Because of these reasons, responses will be based on The code (Computing Machinery 2018) and inform on the different stakeholders. The team wanted to introduce the students to a safe discussion environment where the point is not to seem most ethical to the public eye, but think of the company's best interests, and evaluate all stakeholders. Because of this, the voting will be anonymous. Boiling down the video game to purely situational choices will more solidly fit these agendas and learning goals. It will also help with removing nitty-gritty mechanics that bog down the game with things the player might not want to do.

The idea that the game should be multiplayer with several students collaboratively choosing how to solve the situations, instead of students playing the game single-player, felt like it could give a very interesting contrast to the competitive nature of the card game. The re-design was still based around the idea of IT consultants running a business, but moving it to a classroom setting also meant that it would be easier to implement in a course. The team also felt like the idea seemed more easily approachable for professors, as they might have already used similar programs like Kahoot.

Setup wise, the team wanted this to work with an ecosystem of scenarios made by other people, published to some hub. This was inspired by how Kahoot has a library of different quizzes made by people from all over the world. The team believed this would increase the potential for the game and lower the bar of entry, as a professor who was just looking to test out the game could use scenarios already made instead of having to spend the time making it themselves. It also meant that over time, high quality scenarios might emerge and could be made by anyone who felt like putting in the effort to make a scenario set for something they were knowledge about.

6.1.2 Development process

For this iteration, the team took note of the long development time spent on a Unity prototype for the earlier iteration, and decided to first focus on the broader concepts and quick prototyping.

The team made a Figma storyboard to be shown during interviews, and instead of developing a functioning Unity prototype, they decided on making a paper prototype for user tests and some diagrams for possible future digital prototyping. The team used Kahoot as an inspiration for the base structure for the development of the game.

The game requires 3 clients. Firstly it needs a teacher hub webpage which needs the capability to create, start and end game sessions, as well as displaying statistics from the different groups at the end. The team also wants it to have login functionality and be capable of creating new sets of problems for the students to solve, and possibly the ability to share problem sets with others, but for simplicity it will come with pre-made sets in this iteration. Secondly, the game requires a group hub where one student will use their laptop to connect to the game session. This client will keep tabs on the voting, and display the information to the students. Lastly, the game requires a player client. Each student will use this client on their phone to connect to their group session and vote for the responses.

The flow diagram 6.1.2 shows the functionality needed by each client to finish a game.

The database diagram 6.1.2 shows a simple database structure proposed for the game.

Figure 6.1: Flow diagram for a game session

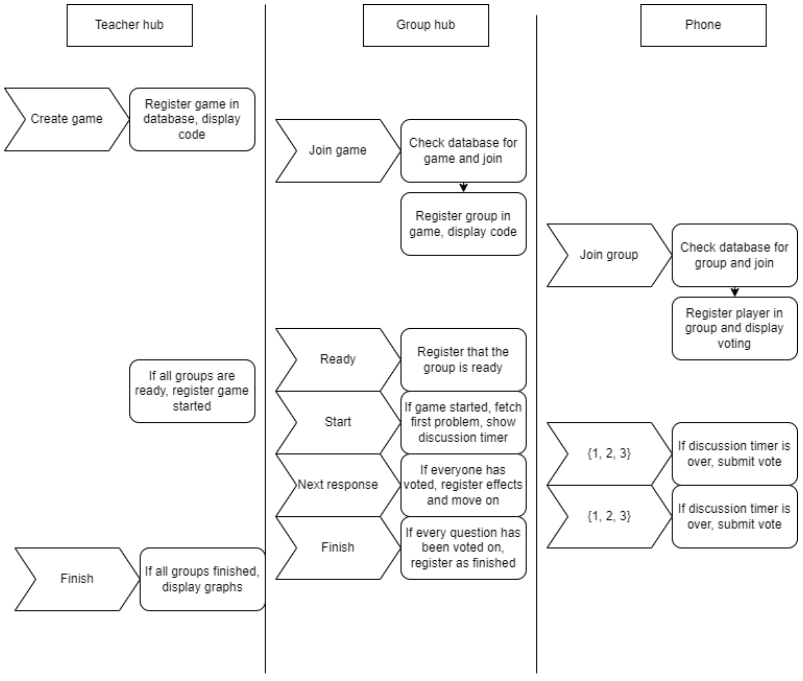
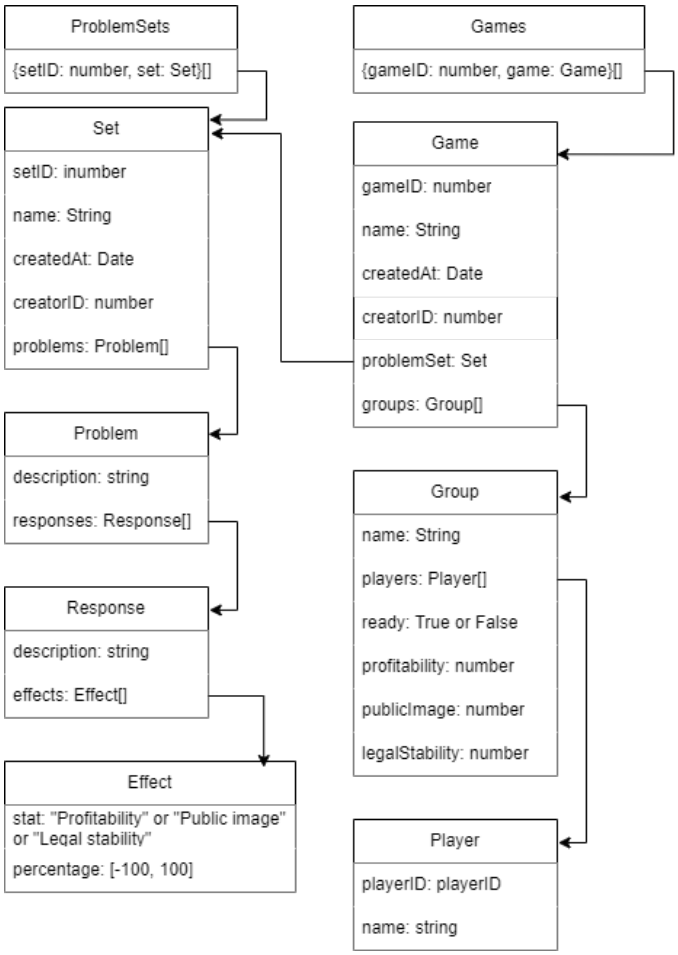


Figure 6.2: Simple database diagram for a game session



6.2 Card game

6.2.1 Design process

In order to improve the design of the card game, the team focused on changes intended to help students develop their problem-solving skills, and various modifications were proposed based on feedback from the teacher interview. One of the key changes was to make the game more situation-specific. To achieve this, the investor role and industry cards were removed and replaced with domain decks that are tailored to specific situations.

Each domain deck focuses on a specific area, such as elder-care, and contains a set of persona cards. These cards describe individuals with specific traits, which may imply certain needs and issues. The players' objective is to understand these needs and issues, and then use their problem-solving skills to come up with a product that will help meet them. By doing so, they will be able to better grasp the complexity of real-world situations and develop effective solutions.

To make the game more relevant to the specific situations described by the persona cards, each domain deck will also include corresponding tech and weaknesses decks. These will provide players with a set of relevant technologies and challenges that they can use to further develop their problem-solving and discussion skills. The inclusion of these decks will allow players to develop a more nuanced understanding of the situation, and will help them come up with more creative and effective solutions.

6.2.2 Development process

To demonstrate how these modifications can be implemented in practice, the domain of welfare technology was chosen as an example for the project. It was decided that a small deck with up to 3 personas with different needs would be chosen, and that a deck of 10 technologies and 10 weaknesses would be made with consideration to be usable within the domain.

To develop the prototype, the team looked back at the information gathered in 4.

6.3 Content generator

6.3.1 Design process

In the last iteration, a python script was created to speed up the development process for the card game. This made it easier to prototype cards, and added a level of modifiability. In the interview with the computer science professor in 5.3.4, the concept of "wildcards" are brought up as a way for professors to possibly cater decks to their own needs. Taking this into consideration, the team believed it might have been a good idea to make a more accessible version of this that professors could use, as the original python script proved cumbersome to use. Having to either directly write the JSON lists or use a terminal program made it hard to manage the card lists, and would likely not be something most professors would care to use. It was also hard to pin down the structure of the program, especially when the core mechanics of the game were up for change. The list of use-cases for this webpage would be left to be extended in the future, but in broad terms it was meant to be a place where one could easily generate content for the games.

The team decided that this content generator would become a permanent addition to the ecosystem, and would at the very least work as the tool for facilitating future use of the card game. Anyone would be able to use the website to generate new decks fitted to their use case, and it was decided the site would also include an explanation for the rules and guidelines for creating cards. Additionally, the website could also host a copy of this very thesis, and work as a host and or content generator for the video game as well. However, as the concept of the video game changed, the content generator was left only being used for the card game. While this is fine, the site could still host or link to the video game, and contain explanation of the mechanics and how a professor could utilize it in their class.

In the end, the team chose to host the new video game on the site. In practice, this would mean one single website that hosted both the content generator for the card game and hosted the video game's different clients on separate subdomains. Therefore, the team decided that the new form of the content generator would be a hub page for the entire project. The webpage would have a homepage, made to simply introduce the user to the project and be the central point of the hub. From here, the user could go to which ever subdomain they already had in mind, or read about the project itself. This design choice means that in future, more projects could be added as the collection of games potentially expands.

6.3.2 Development process

The team decided to create a web app using Svelte deployed using Vercel, which worked similarly to the python script, with the added convenience of a graphical interface. The web app lets the user generate as many decks as they want with specific names, and then add cards to these decks. They can then choose to either export the decks to a JSON format, or print to PDF. When printing to PDF, you have the choice between printing only the card contents, or printing in a double-sided format with the deck name on the back of the page. You can also import JSON files to load previously made decks.

It was decided that further extension of the hub would be left to later iterations, as the main use-case was to be a content generator for the card game. Lastly, the team added a homepage with some information on the project itself, with future plans of adding links to the GitHub repositories and a copy of the final master thesis. This became the basis for the content generator and acted as a first iteration on the concept.

In Figure 6.3.2, you can see a screenshot from the front page. It is mainly non-functional, outside providing text and links. The only links that actually work in this version are the links to the content generator for the card game. The names are also not updated to the final names for the games.

Figure 6.3: Screenshot of the hub front page.

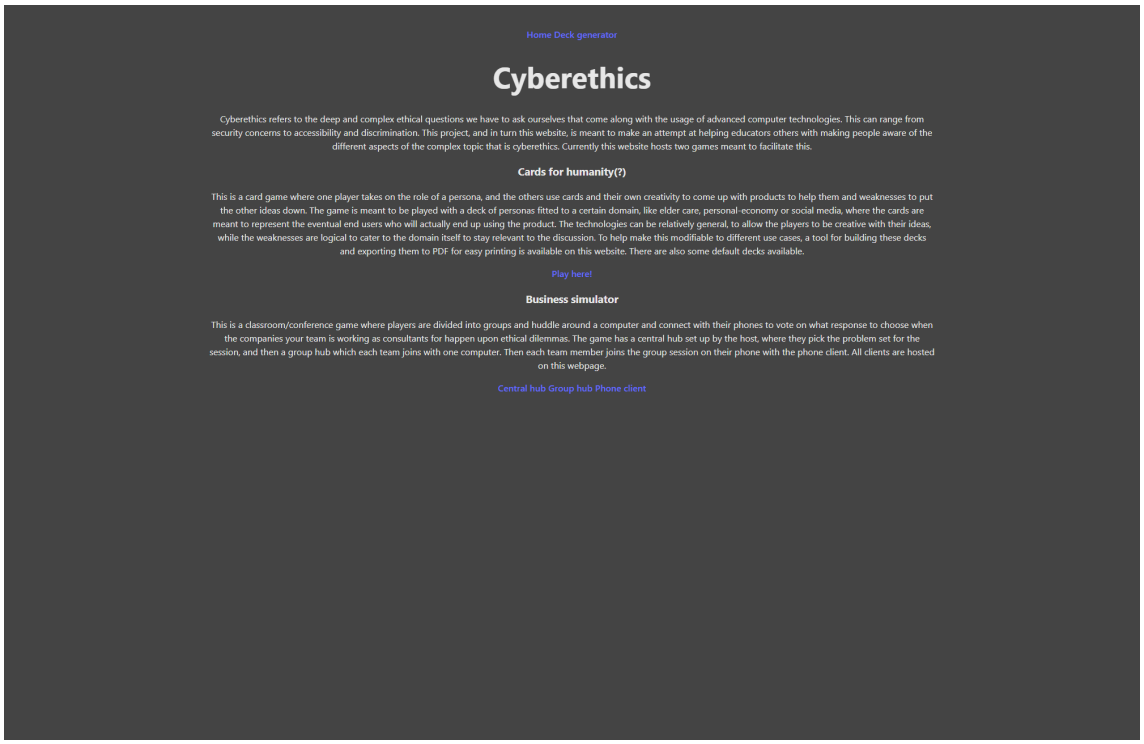
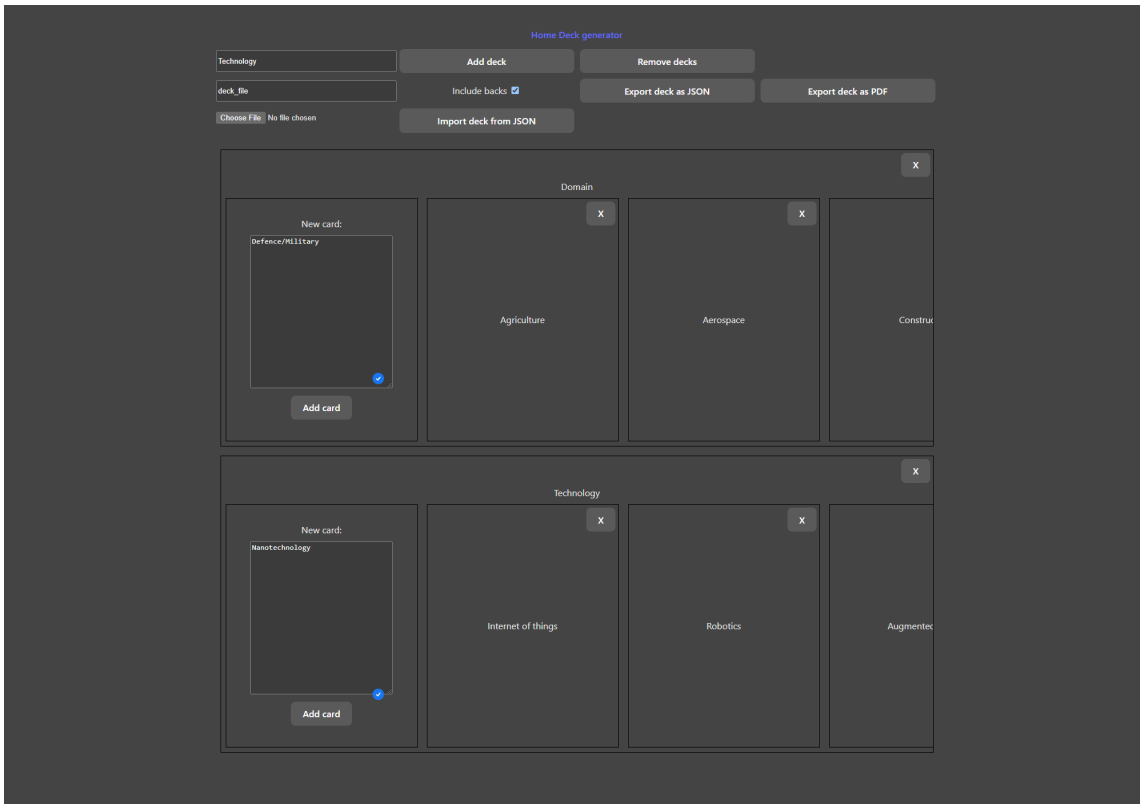


Figure 6.4: This is a screenshot of the content generator for the card game.



6.4 Evaluation

To evaluate the revised game designs, the team chose to conduct two interviews with computer science students. This was to better understand the perspective of the intended player demographic.

6.4.1 Method

To evaluate the revised concepts following the feedback from the expert interviews held in chapter 5, the team wanted to explore how computer science students would react to the game concepts. Unlike the previous interviews, students group are not used as a source of expertise, but strictly as user group representatives and potential future players. They will give feedback regarding their values, impressions and experiences. Their thoughts and feedback will give an impression on how the tools would be received.

Similarly to the previous interviews, this round was conducted physically colocated with an audio recording device in the middle of the table, recording the conversation. The recording device used in this iteration was provided by the supervisor and the data recorded was immediately after the interview transferred directly to NTNUs servers. The consent form can be seen in appendix I and the interview guide can be seen in appendix N. The interviews were performed in Norwegian. The students participating in the interviews were offered a soda as a symbolic reward.

6.4.2 Summary of interview with student 1

They described their experience with ethics in their study as minimal outside EXPHIL and being told to follow guidelines for design in their bachelors project. There had not been much focus on discussion, but rather on reflection and process in essays. At most, they would discuss some viewpoints in EXPHIL. They had not used games in their university education outside of Kahoot, but had encountered it at high school and in self study. They believe it could have a positive effect and is easier to make fun than traditional studying, making people more engaged and letting them partake actively in learning.

First, the team presented the video game. Their first impression was that it would be very new to people without business experience, and thought that it is important to make it more abstract and remove details and complexity, and rather focus on players getting into the role-play. The single-player experience seemed like something they'd perhaps enjoy at a younger age as self study, but they preferred the new simpler video game concept for the above-mentioned reasons, and said it had similarities to some role-play exercises they had done in EXPHIL. They say it's important to hold a balance between giving the players information and letting them think for themselves. They would be positive to a professor trying a game as presented in class, preferably in a normal lesson, but could also possibly work as part of an independent group activity.

As for the card game, they found it exciting and very to the point, and liked the concrete examples. They do not believe it would be hard to come up with ideas with the cards as they are, and that it would be a problem if they were too vague.They pointed out the mechanics of giving feedback and critique, and that ethical problems occur by quickly thinking of technological solutions without thinking of the aftermath. They found it interesting to have to argument for your technology, even if you felt the added weakness made it useless. They also liked how the personas made the situations feel real, and perhaps throw out some dark humour if the cards built up to it. They said that being easy to imagine could be both a downside and an upside, as while it could help inspiration, it could also be daunting for some to explore. They thought it would probably work best in seminar settings. In normal lectures it might be easy to be annoyed as they were expecting to be able to be more passive in the lecture. Still, it would be best to have the teacher there at least to tell students to play, as bringing it to a group project meeting or similar with no supervision might be met with low enthusiasm.

6.4.3 Summary of interview with student 2

They described having experience with a course focused on ethics, specifically GDPR. It was mainly focused on following security protocols. They expressed that they had relatively little ethical education outside this and EXPHIL at university. They did however say that they had been given some introduction to ethics and protocols in their summer internships. They had experience with some educational games in early age, and later Kahoot and some role-play in a Design Thinking course. One course on IT leadership had a game about the stock market, which they found fun. They believe educational games are a good idea, which is why they're popular. They help people stay engaged.

First, the team presented the video game. They thought it sounded like a cool idea, with the possibility to show some exciting ethical dilemmas. They said it was a smart idea to boil down the game to the core mechanic of responding to events. They liked that it gives a group dynamic where you can share thoughts and ideas, and that the most interesting part is usually the discussion and not the result. In their opinion, the game seemed to fit security related courses, and of course those that were generally related to ethical decision-making where several factors were at play.

As for the card game, they thought that the act of putting yourselves in the shoes of the person in the described situation was a good way of learning. They believed that the act of exploring the situation itself has a lot of power, and that trying to understand the worst in a situation lets a person learn a lot. They had some similar experience at their summer internship, where they would do role-play surrounding how to solve issues if money and time was not an issue. Then they would argue why specifically it was not possible to do currently, to try to find ways to make it possible right now. They thought the game could be fun in a group setting to solve issues in a design process, but that it would depend on who was in their group. It seemed like a card game fitting for courses where you design and even perhaps develop a

product. Things like a design thinking course, entrepreneurship or tech-lead courses where the market is important.

6.4.4 Discussion

The students both confirmed our previous belief that computer science students have very little ethics education at university. They did however point out that other arenas such as summer internships could provide additional training on such subjects, which should be taken into account when discussing whether the average ethical education of computer science students is apt or not. They seemed to both have limited but still some exposure to educational games, but often less so at higher levels of education and often in self-study. Despite this, they were both very positive to the use of games for education, and seem to agree with the literature presented in chapter 2 which states that educational game can help learning by increasing engagement.

As for the games, they seemed to be positive to the suggested changes presented during the interview. This affirmed that the change from sector cards to persona cards in Startupsuperfight, and simplifying and redesigning Consultant Tycoon for multiplayer, made the games more suitable for our target demographic. The team believes that based on these interviews, the games were ready for play-testing after some minor changes and development of more comprehensive paper prototypes.

Chapter 7

Final iteration

7.1 Consultant Tycoon

7.1.1 Development

Following the positive reception of the new multiplayer version of Consultant Tycoon in the last iteration, the team decided to explore this version further by creating a full paper prototype that could be used to test this concept.

When expanding the Figma prototype to allow a full play session, the team thought it would be fitting to expand it sufficiently to the point where the players can spend time with multiple dilemmas to potentially give better feedback. Additionally, the team thought that they could get a clearer picture of how the game facilitates for discussion, as desired in RQ 1, if they get to witness multiple discussions. From these assumptions the team thought it was necessary for it to include: a welcome screen, introduction to the game story, a set of ethical dilemmas and an ending screen.

The team implemented five ethical dilemmas into this iteration of the prototype. Each dilemma was borrowed from chapter 4. The team reformulated the three theoretical cases borrowed from the code to fit within the storyline and created entirely new ones related to the other issues discussed in chapter 4.

7.1.2 Storyboard

This section will go through the game loop for the revised Consultant Tycoon concept. The rest of the prototype created for this iteration is shown in appendix C, this includes all the various cases and they would be used similarly as described in this storyboard.

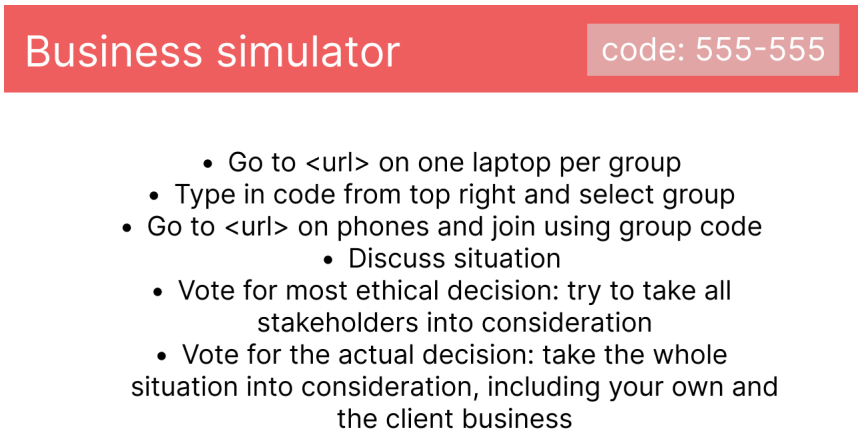


Figure 7.1: Main menu screen

Figure 7.1 shows how a theoretical teacher's screen would look after setting up a game of Consultant Tycoon. The players would go to a URL on a laptop and join a group, before joining the same group on their phones.

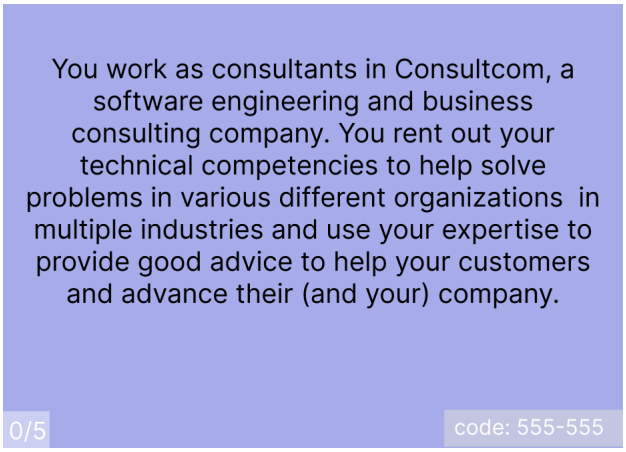


Figure 7.2: Introduction screen to game story

Figure 7.2 shows the first screen the player groups see when they join a game session. This screen explains what role the players have in the game and in what context the players encounter the dilemmas they have to act on.

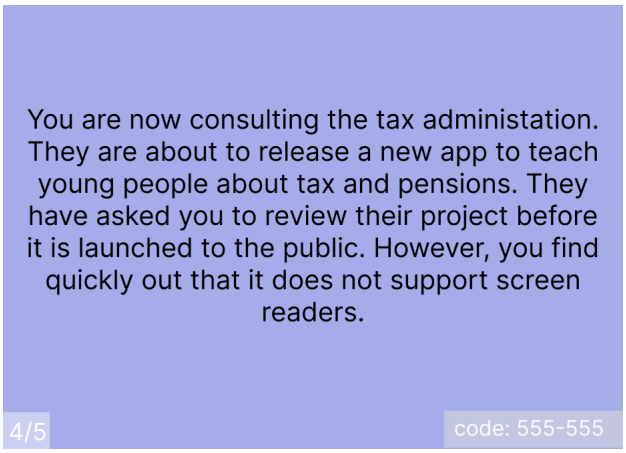
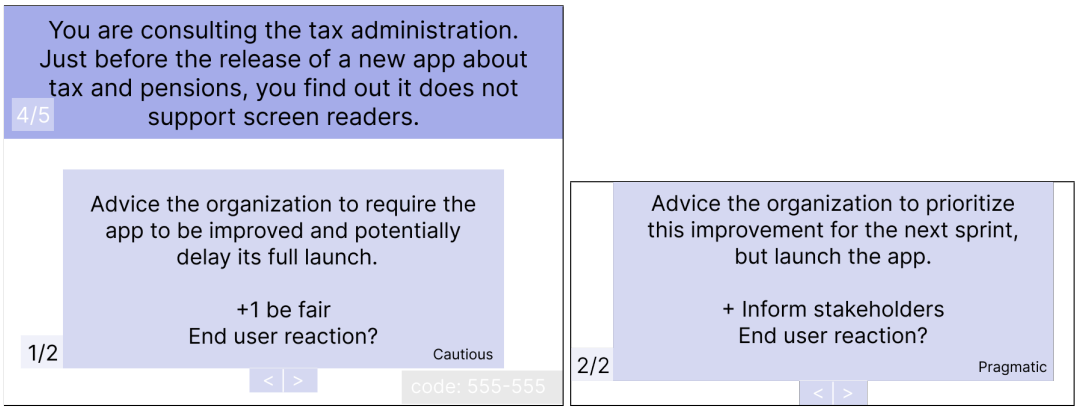


Figure 7.3: Case info screen

Figure 7.3 shows how a dilemma is introduced to the team, the players would see this screen on their groups' laptop. Theoretically this could be open to multiple forms of media, but due to the team wanting to test the game as a paper prototype, text as seen as the best solution. The white numbers in the bottom left corner describes which dilemma you are currently studying, Figure 7.3 is for example the fourth dilemma out of the five made for this prototype, and is based on the issue discussed in Section 4.1.5. By clicking on the screen, the players will be brought to a new screen, giving an abstract of the dilemma and possible actions, as seen in Figure 7.4a.



(a) main case screen (b) option 2 for player action

Figure 7.4: Example of case screen

Figure 7.4a shows the main screen the players interact with in the game loop. On the top of the Figure, you can see a short abstract of what the dilemma is about. below that, a possible option for what the player can do in response to the dilemma. Figure 7.4b shows how the second option of what the players can do in the ethical dilemma, the number seen to the left of both options indicate which number is associated with the option and in turn what button the player needs to press to select it.

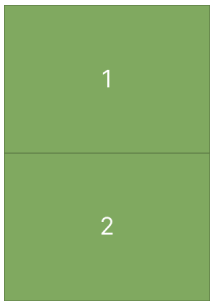
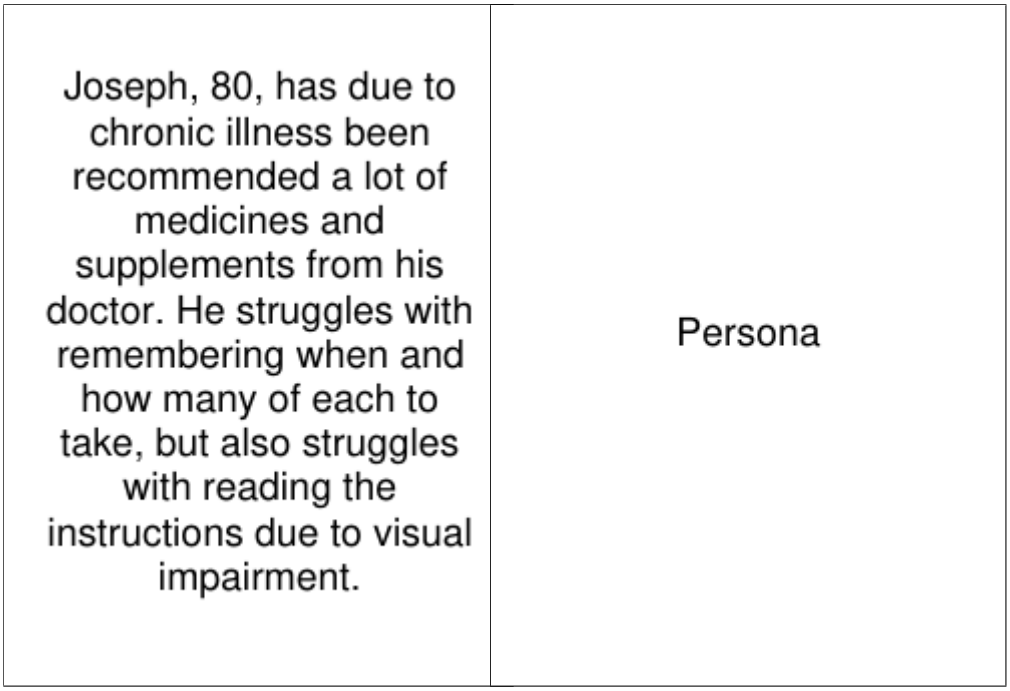


Figure 7.5: Phone voting screen

Figure 7.5 shows how the phone voting screen looks. In the example shown in this storyboard, there are two possible actions, corresponding to two fields the players can press on their phone. Depending on the amount of possible actions presented in the case, the screen is thought to divide itself into more fields. A form of voting was seen as a necessity to make the game progress in situations where the players in a game fail to reach a consensus on what option to choose in a dilemma.

7.2 Startupsuperfight

The startupsuperfight concept received very positive feedback on the previous iterations, so only a few changes to the concept needed to be done to allow for a session of the game. The biggest new change to the game concept was the creation of the new persona cards. An example of how the new persona card looks can be seen in Figure 7.6. The persona cards fit the exact same role as the sector cards in the original storyboard in chapter 3, the team therefore decided to not include a new storyboard in this section.



(a) Front side of persona card (b) Back of persona card

Figure 7.6: Example of persona card

When it comes to the creation of the prototype, the team struggled with making the ruleset fit on cards. Due to this being a small part of the game concept, the team decided that it was permissible to present the ruleset in another way. The team then decided to put the ruleset in the interview guide that will be used in the play session.

The cards were created by using the generation tool described in Section 6.3. The JSON file used for generating the card deck for this iterations prototype can be found in appendix A.

7.3 User tests

As a final activity to use in the evaluation of the concepts developed during the process, the team saw it necessary to have users test the prototypes. Having user group representatives interact with the games as research artefacts was seen as a necessity, as this is the most authentic way to receive feedback on the concepts and how they have been implemented. This section will explain the methodology used in the evaluation, the results that came forward, and a discussion regarding their implications.

7.3.1 Methodology

To evaluate the concepts, the team performed user tests that were held as semi-structured group interviews, with play sessions as an activity to break up the interview. The interview methodology allowed the team to gather qualitative data regarding thoughts and impressions of the prototype. Due to the game concepts being multiplayer, the team chose to perform the interviews in groups of three, as this is big enough for the players to play the games without the team members taking any role beyond controlling the paper prototype.

The interviews were performed similarly to the previous expert and user group representative interviews. They were performed physically colocated around a table, with an audio recording device in the middle of the table. The participants are placed on one side of the table and the team member conducting the interview on the opposite side. The recordings were saved directly on the device and later transferred directly onto NTNUs servers.

Due to the difference between the prototypes, the games were tested slightly differently. After an initial introduction to the project, a team member placed the three card decks from Startupsuperfight and explained the rules of the game. The players then played through the game without any involvement of the team member. The business simulator was tested as a paper prototype of a digital application, controlled by a team member. This was done as it was seen as essential that the concept gets tested properly as a paper prototype before it potentially gets implemented. In practical terms, this means that the graphical user interface and logic of the game was controlled by one of the hosts of the user test.

Participants for the interviews were recruited through interactions with student organisations within the department of computer science. To reward the participants for their time, the team ordered pizza and 1.5 litres of soda for the event. The information letter used can be seen in Section I and the interview guide can be seen in Section O.

7.3.2 Results

Due to the nature of the game prototypes developed and evaluated in this iteration, the results from the group interview in this section will be described as a whole. By this iteration, both game concepts have become multiplayer games, making many of the observations and interview answers shared between multiple players. The interview questions were also asked to the players as a group, and they were free to answer, discuss and build upon each other's thoughts.

Startupsuperfight was the first game to be tested. During the initial round, each player expressed they felt somewhat insecure in the rules of the game and how they should present their ideas. During the second round the players started acting more comfortably when presenting their ideas, expressing how their ideas would help the persona and acting more comfortably when criticising each other's ideas. During the interview, the players expressed that they needed some time to loosen up and

get used to how they could present an argument in the context of the game. When asked about this development, the players expressed that they got into *the zone*, as soon as they got a clearer mental image of how the game is supposed to be played.

When asked about if they recognised the underlying game that inspired Startupsuperfight, the team discussed how parts of it remind them of Cards Against Humanity. Cards Against Humanity is in some ways a similar game, where many of the games systems mirror each other.

When asked how they felt about competition as a driver of discussion, the players expressed how it could be a double-edged sword. They felt that discussions were limited by how only one person would support and another would criticise ideas, the players expressed that relevant arguments and details could be left unexplored when found by someone who will not benefit from it in the game. The players suggested incorporating secondary goals in the game to address this issue.

The players felt that they only got to the point of a surface level exploration of the various ethical cases. The players only got to discuss consequences for other potential stakeholders one time in the seven rounds played. They also expressed that their explanations when it comes to both the technologies they proposed and the potential issues related to them got more elaborate during the play session.

Following a short break to enjoy the pizza and soda reward, the players moved on to try Consultant Tycoon. The team member responsible for the interview then gave a short introduction explaining how the prototype will be tested and placed the first screen before the players. As soon as the first case was introduced, the players seemed to immediately pick up on most of the games systems. The players would discuss the scenario, their existing understanding of the topic represented in the dilemma, and share their assumptions regarding both the problems and the possible answers.

In the post-game interview, when asked about their thoughts more broadly about the game, they said they enjoyed the game for very different reasons compared to Startupsuperfight. They expressed that it felt good to get to spend more time talking about very specific scenarios. When asked about if they recognised the underlying game that the simulator was inspired by, the group referenced the games produced by the company Telltale Incorporated.

The group was then asked what they thought about a game being driven by narrative. To this, the players expressed that it was nice that the situations were tied together, but felt that the story focusing on a few different companies made the experience feel somewhat disjointed. The players suggested that a new iteration of this game should have a story focusing on a company working in a specific domain, similarly to how the Startupsuperfight prototype focused on the domain of assistive technologies for elder case.

When asked how they felt about the presentation of the dilemmas, the players repeated that they would have preferred a more cohesive storyline. They expressed that they would prefer to keep the dilemmas inside one company and perhaps with some deeper connection to a company and potentially the people inside the com-

panies. They suggested that the introductions of the dilemmas could potentially include people from the inside of the companies expressing their concerns and motivations. The players also commented that the numbers and text on the bottom of each action were confusing and led to them spending time thinking about how the game would interpret or act on their decisions.

For this iteration, the team did not fully implement any of the random-number generator mechanics and consequence screens that were desired in the concept. When asked about their thoughts on such mechanics, the group found the idea interesting and expressed that such a mechanic would make sense considering some actions might cause unpredictable external or internal responses in the real world.

When asked what they thought about the dilemmas being based on real cases and current issues, the players responded positively. They expressed that they found the dilemmas to be relevant to their broader field of study, and that similar situations to some of the dilemmas had been discussed during past internships and university courses.

7.3.3 Discussion

The players recognising some of the game systems in Startupsuperfight from another game they have played in the past could be a contributing factor to how quickly the players understood the game systems. Due to this factor, it would be difficult to assert the difficulty level of playing the game for students who do not have the same experience with similar games.

The players' experience with competition in Startupsuperfight in this iteration was on some levels a mixed bag. The positive traits of the play sessions mainly revolved around the players enthusiastically partaking in the discussions. In the post game interview, the players expressed enjoying the game and getting in the zone when playing. The negative aspects mainly laid in how surface level the discussions became. The discussions mainly focused on a single stakeholder's perspective on the product, namely the persona that one of the players take on themselves and gives out points to their favoured idea.

In a theoretical future iteration, the team could explore the suggestion made by the players that there should be added a mechanic exploring the consequences for other stakeholders. Among the suggestions was a secondary stakeholder that who's interests could be affected by the implementation of the technology. They could be other relevant stakeholders within the domain the game is applied in. In the context of assistive technologies within elder care, these additional stakeholders could be potential nurses, doctors, investors, administrators, or a politician with a relevant mandate.

Consultant Tycoon received positive feedback by the players, and this feedback supported the desired outcomes of playing the game. The players expressed interest in the game as an activity, but did not express that they got into the zone in the same way as they did in Startupsuperfight.

The players commented that Consultant Tycoon allowed for a more in-depth form of discussion. The game allowed for more discussions regarding potential stakeholders in each situation and how they would be affected by the decisions made. Additionally, the players would to a larger degree build upon each other's arguments, share their assumptions regarding the situation and create consensus regarding their actions. This is something the team attributes to the collaborative nature of the game, as the players are playing as a team and can only make one action, they could be thought to have a motivation to reach a consensus. Additionally, supporting or contributing to other players' ideas is not putting the player in a competitive disadvantage.

The proposed idea of staying within one company and providing a closer connection to the employees mirrors aspects of Quandary (chapter 2), and could be interesting aspects to explore in a potential future iteration. Providing the viewpoints from different employees and having the players take this into consideration could deepen a player's immersion and investment in what happens to the company. This is deepened if the players stay as consultants for a single company, at least for a few repeating scenarios. In a future iteration, the team would also consider removing the indicators on the bottom of each option, as they inspired a degree of metagaming, as the players started thinking about the option from how the game itself might judge it.

The results of this iteration shows that at this point, the Consultant Tycoon concept has some advantages over the current iteration of Startupsuperfight as a tool to promote ethical discussion. However, to get a clearer insight into this, an additional iteration that would improve upon both concepts could see how deeply the issues lie within the concepts and if certain changes to the games could improve their ability to contribute to having ethical discussion.

Chapter 8

Conclusions

8.1 Summary of results

The main contribution of this thesis is the game concepts and their evaluations. The concepts initially being created in chapter 3 and further developed through an iterative process as described in chapter 5, chapter 6 and chapter 7. This thesis contributes to the field of games for ethics education for computer science students by creating two new game concepts, where both the development of the concept and evaluation of their associated prototypes could be used as a basis for later game development.

As explained in the motivation, there are ongoing discussions about the role of ethics within the field of computer science and prominent organisations have made demands for more ethics education for computer science students. The team has attempted to give new insights into how games for ethics education for computer scientists can be created by creating two different game concepts. Where both concepts utilise a different way to play to facilitate discussions about ethical issues and help computer science students practice ethical decision-making within their field of study.

8.1.1 Research questions

The research questions(RQs) of this thesis have been the point of focus during the run of the project. This section will go through each RQ of this thesis, explain what answers the team has found, and describe to which degree the RQs have been answered. The main RQ is meant to encompass two sub-RQs and the degree of which the main RQ is answered is dependent on the sub-RQs.

RQ1: "How can games be designed to facilitate for ethics discussion for computer science students?"

As shown in the literature review, most previous attempts at developing games for

ethics education have been narrative-driven single player experiences, where the individual players encounter ethical dilemmas on their own. To build upon this knowledge, the team decided to explore the possibilities of creating multiplayer games that allow computer science students to discuss ethical issues and make ethical decisions together. During the run of this thesis, two game concepts have been developed to explore two different forms of multiplayer play; competitive and collaborative. These game concepts have both gone through a development process consisting of three iterations, where the concepts have been criticised and improved using interviews with relevant potential stakeholders. The game concepts, their creation processes and their evaluations will be involved in answering this RQ.

The effectiveness of any ethics education can be difficult to measure, so the main educational goal within ethics in this thesis laid in helping students practice discussing ethical dilemmas and ethical decision-making using games. The game concepts were based on existing commercial game titles that incorporate some aspects that could be leveraged to facilitate interaction with ethical dilemmas. Firstly, Startupsuperfight borrowed most of its mechanics from the commercial title Snake Oil, which were the inspiration for Startupsuperfights creation. Snake Oil is a competitive game where two or more players develop their own product and an outsider, taking the role of a specific customer, chooses the most satisfactory concept. The second game concept, Consultant Tycoon, was initially inspired by Game Dev Tycoon, a business simulation game where the player mainly focuses on maintaining the business. The team chose to remove the simulation aspect, but increase the focus on creating a narrative driven experience where the team kept focus on ethical dilemmas.

During the interviews following the play session, the game concepts received positive feedback regarding enjoyment and mainly positive feedback regarding the quality of discussions. Startupsuperfight received one major criticism, this being how the game creates very narrow discussions, mainly focusing on a single stakeholder, the persona themselves. Future utilisation of this approach for the creation of games to facilitate for ethics discussion for computer scientists would therefore need to take into account how the games that inspire their development could limit the scope of conversations.

The research question has been answered in a satisfactory manner, with relevant research activities and useful data. A weakness in regard to the answer is the fact that this thesis explored two different game concepts. This contributes to the results being explored in a wider, but more shallow manner, compared to an approach that would focus on a specific concept. However, this decision was seen as a worthwhile trade-off, as it allowed the team to explore both competitive and collaborative game concepts.

RQ1.1: "How could competitiveness be implemented into a game to facilitate for ethics education for computer science students?"

During the preparatory project, no attempts to leverage competition as a driver of ethical discussion in games for ethics education were found. In an attempt to do

this, the team explored existing commercial game titles that focus on competition as a factor to push for topical discussions. The team chose the games Snake Oil and Superfight to take inspiration from. The team chose to create a prototype focusing on the topic of assistive technologies for elder care. To populate the game with cards, the team created personas of elders in need of assistive technologies, defined some weaknesses that could have meaningful consequences and a long list of potential technologies to create cards. The team then used these card with a ruleset inspired by the game Snake Oil to create a new game within the relevant topic.

During the play session during the third iteration Startupsuperfight the prototype was found to be successful in creating conversation around ethical consequences of theoretical technological solutions. The players got to discuss both the potential consequences on stakeholders of their technological choices and the potential solutions or alleviating factors for these problems. However, while playing the prototype, it became clear that the conversations rarely explored potential stakeholders or wider implications for others beyond the end user persona. There were made suggestions on how to alleviate this, such as adding another stakeholder deck, or mixing in other stakeholders into the persona deck, however they remained untested due to time limitations. The team's approach of adapting a competitive game focused on discussion was therefore found to be partially successful in creating games that facilitate for ethics education for computer science students. However, attention has to be paid to how the game could focus conversations on narrow perspectives.

Due to Startupsuperfight only having one iteration where the game was actively played, the depth of the results can be considered shallow. That iteration also only had three players, which leaves open the possibility that there are problems with the concepts that were not highlighted during the test play sessions. Due to shortcomings in the conversations observed during the play session of Startupsuperfight and the potential solutions that remained untested, the team thinks that RQ 1.1 was not fully answered.

RQ1.2: "How could collaboration be implemented into a game to facilitate for ethics education for computer science students?"

In order to facilitate for ethics education, the team found it interesting to explore the potential in creating a game for ethics education by allowing students to practice ethical decision-making. To do this, the team wanted to explore commercial game titles that put an emphasis on making decisions. The team chose to take inspiration from game dev tycoon and the games developed by Telltale Incorporated, to create a narrative driven game that puts the players into the shoes of a consultant who has to deal with ethical dilemmas in a professional setting.

Following an initial round of interviews with experts, described in chapter 5, the team decided to focus on a narrative driven experience and dropped the business simulation aspect from the game concept. By recommendation from the game experts interviewed, the team also decided to also make the game a multiplayer experience. By having the players vote for shared action, the team thought they could push the players to discuss the dilemmas in the game. During the play session in

chapter 7, this approach proved successful, and the players had longer discussions where they shared background knowledge, assumptions they make regarding details in the cases and built arguments together. Often building on top of shared assumptions and each other's thoughts to create a consensus regarding which option to choose.

Consultant Tycoon was only played once with three players, and the results therefore could miss some factors that could affect the results of future tests with users. The results of the play session in the final iteration were positive and indicate that the game satisfies its intended purpose. The team thinks that RQ 1.2 was answered to a satisfactory degree.

8.2 Limitations

This section will go through the strengths and limitations of this thesis and its results.

Due to the intersection of multiple fields of research that are relevant within the topic of this thesis, such as pedagogy and ethics, the team has attempted to be as clear as possible with how they integrate these fields within this thesis. An example of this is the ethical cases and topics discussed in chapter 4, that chapter mainly served as a means to create the prototype in the third iteration of the prototype as described in chapter 7. To deal with these intersections, the team depended heavily on external resources to populate necessary parts of the process that are by themselves not directly related to the RQs.

In terms of methodology, DSR has shown itself to work well with exploring the research questions of this thesis. DSR methodology laid the groundwork for the team to start an iterative process to create and improve artefacts, in the form of prototypes, to evaluate both the prototypes and the concepts that inspired them. Testing the prototypes with users allowed the team to explore how they enabled the students to have ethical discussions and practice ethical decision-making.

A weakness in how the DSR methodology was applied in this thesis lays in how the artefacts were adversely affected by how short the project run was. When utilising a DSR methodology, having the opportunity to perform additional design cycles to improve the concepts and prototypes could have allowed the team to gain more knowledge and explore the RQs more deeply. A theoretical fourth prototype iteration could allow the team to for example explore adding a new stakeholder deck to Startupsuperfight and see how this would affect the discussions between the players. Exploring such changes in a new iteration would add more depth to the answers to the RQs.

When it comes to the learning outcomes, it is difficult to measure exactly what a person gains from ethics education in general. As discussed in Section 5.3.5, what a person gains from any ethics education can be very subjective and could be connected to a person's interests. Due to the difficulty with measuring learning outcomes from ethics education, this was for the most part left unexplored in this

thesis. The contribution the prototypes attempted to do to ethics education for computer science students was specifically if it facilitated for students to discuss the topics and what aspects of the dilemma were discussed.

8.3 Future development

In terms of future work, there are a lot of interesting directions to go from here. The team believes another iteration with more focus on design and development would be able to put the findings in chapter 4 and chapter 2 to good use. The team believes that a good way to start would be to workshop the scenarios for the video game with professors and later implement the code (Computing Machinery 2018) in the responses. The same or a similar workshop would be an ideal opportunity to develop personas for the card game as well. A team wanting to improve upon StartupSuperfight could benefit from having members with expertise in one of the fields of study the team writing this thesis was lacking. For example, having a team member with skills in creative writing to improve the personas in Startupsuperfight or improve the story, write consequence screens to the dilemma decisions or implement potential non-player characters in Consultant Tycoon. Other relevant expertise, such as in pedagogy or any of the relevant domains in the cases discussed in chapter 4 could also be beneficial.

A new prototype for Consultant Tycoon following the proposed design is thought to be easy to implement as a subdomain on the existing website that hosts the card generator used in chapter 7. It could also be beneficial to involve someone experienced in design to develop a more appealing and user friendly layout. No usability tests were performed due to the process still being in an early stage, making this a nessesity before implementing the concept digitally. As for the card game, it would be interesting to explore the use of secondary stakeholders to complicate the ethical dilemmas of the technologies or mixing in personas related to other stakeholders within the chosen domain. Larger scale testing with students is also needed to get feedback for fine-tuning the mechanics of both games.

It would also be interesting to explore the concept of a board game using the mechanics mentioned in Section 5.3.6 that didn't seem to fit the video game. As some mechanics also were left out due to time constraints and because the team wanted to simplify the prototype, it would also be good to see if these mechanics could potentially be added.

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Appendix

A card deck

The following block of data was used to generate the cards on the third iteration of Startupsuperfight. The weaknesses were generated multiple times to ensure enough cards to play a full game.

["cards":["John, 70, has recently been diagnosed with dementia and struggles with memory loss and confusion. He wants to be less scared and more independent in his daily life.","Edith, 87, lives alone and has mobility issues that make it difficult for her to perform daily activities. She is ashamed that she depends so much on family for help. But also fears losing her independence in an elder home.","Maria, 95, lives in a nursing home and experiences social isolation due to the difficulty of meeting her family and few surviving friends. ","Joseph, 80, has due to chronic illness been recommended a lot of medicines and supplements from his doctor. He struggles with remembering when and how many of each to take, but also struggles with reading the instructions due to visual impairment.","Margreth, 74, lives by herself and struggles with boredom in her daily life. Due to poor physical health her ability to partake in outdoors activity is more limited than before, making her normal interests more difficult to engage in.","Gary, 76, lives at home by himself, but struggles with movement to such an extent he worries he might have to move into a nursing home. He wants to gain strength or compensate for weaknesses so he can spend a bit more time independently. ","Sarah, 90, has struggles with deteriorating vision to such an extent she is unable to read the small text in books anymore. She loves fiction and finds great joy in being able to enjoy stories on her time alone."],"title":"Persona","cards":["Virtual reality","Augmented reality","Mobile application","Wearable device","Robotics","Smart home technology","Internet of things","3D printing","Generative AI","Joker, I can be whatever you want! Be creative!","A visual computing tool","Exoskeleton ","Land based drone","Flying drone","Website","Video game"],"title":"Technology","cards":["Limited battery life","Aggressive and risky data aggregation","Accessibility barriers for people with visual or hearing impairments","Security vulnerability discovered","Difficult to use for people with limited mobility or cognitive impairments.","Data privacy exploit discovered","How is a poor pensioner supposed to afford this?","Poor energy efficiency","Joker, use your creativity to make up something wrong with their thing!"],"title":"Weaknesses"]

B Python card generation script

```
from fpdf import FPDF
import json


def generateCardBacks(CardType):
```

```
    row = 0
    column = 4
    #Adds new page for back of cards
    pdf.add_page()
    for (index,item) in enumerate(data[CardType]):
        column -= 1
        if column == -1:
            row += 1
            column = 3
        pdf.set_y((col_body+col_title)*row)
        pdf.set_x(50 * column)
        pdf.cell(col_width, col_title+col_body, txt = CardType,
        border = 1, align = 'C')

#opens and returns file content as dictionary
f = open('StartupSuperfight.json')
data = json.load(f)

#saves DPDF class to variable
pdf = FPDF()

#adds blank page
pdf.add_page()

pdf.set_font("Arial", size = 15)

col_width = 50
col_title = 20
col_body = 50

row = 0
column = 0

for (index,item) in enumerate(data["Sectors"]):
    if (column+1)%5 == 0:
        row += 1
        column = 0
    print(index, item)
    item = item
    pdf.set_y((col_body+col_title)*row)
    pdf.set_x(50 * column)
    pdf.cell(col_width, col_title
    , txt = item, border = "LRT", ln = 2, align = 'C')
    pdf.cell(col_width, col_body
    , txt = "", border = "LRB", align = 'C')
    column += 1
generateCardBacks("Sectors")
```

```
pdf.add_page()
row = 0
column = 0
for (index,item) in enumerate(data["Weaknesses"]):
    if (column+1)%5 == 0:
        row += 1
        column = 0
    print(index, item)
    pdf.set_y((col_body+col_title)*row)
    pdf.set_x(50 * column)
    pdf.cell(col_width, col_title, txt = item,
    border = "LRT", ln = 2, align = 'C')
    pdf.cell(col_width, col_body, txt = "",
    border = "LRB", align = 'C')
    column += 1
generateCardBacks("Weaknesses")


pdf.add_page()
row = 0
column = 0
for (index,item) in enumerate(data["Technologies"]):
    if (column+1)%5 == 0:
        row += 1
        column = 0
    print(index, item)
    pdf.set_y((col_body+col_title)*row)
    pdf.set_x(50 * column)
    pdf.cell(col_width, col_title, txt = item,
    border = "LRT", ln = 2, align = 'C')
    pdf.cell(col_width, col_body, txt = "",
    border = "LRB", align = 'C')
    column += 1
generateCardBacks("Technologies")


pdf.output("Output.pdf")
f.close()
```

C Full prototype Consultant Tycoon

This appenix will show every part of the Consultant Tycoon prototype used in the play session in chapter 7. Some additional information that is relevant to its role in the play session as well as some notes on their creation, is also provided.

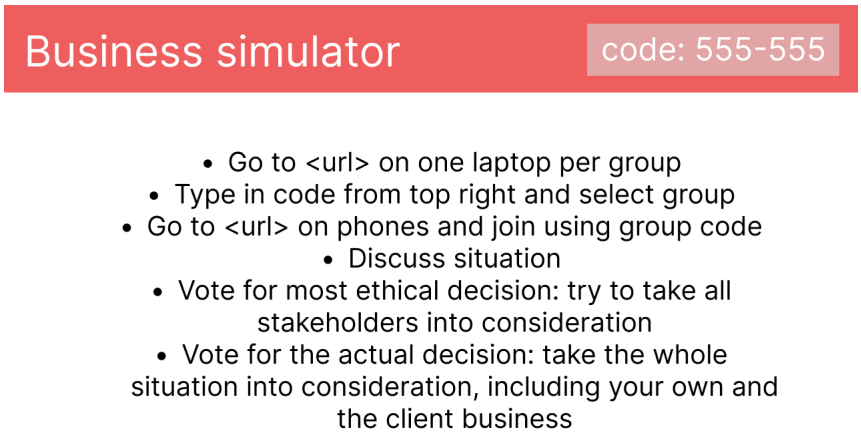


Figure 1: Consultant Tycoon main menu screen

Figure 1 shows how a theoretical teacher's screen would look after setting up a game of Consultant Tycoon. The players would go to a url on a laptop and join a group, before joining the same group on their phones.

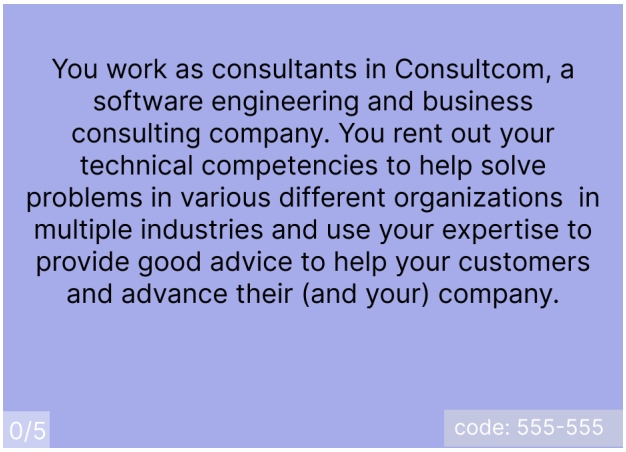
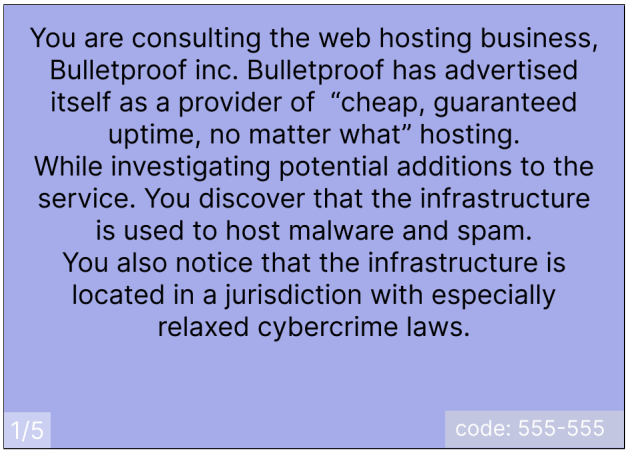
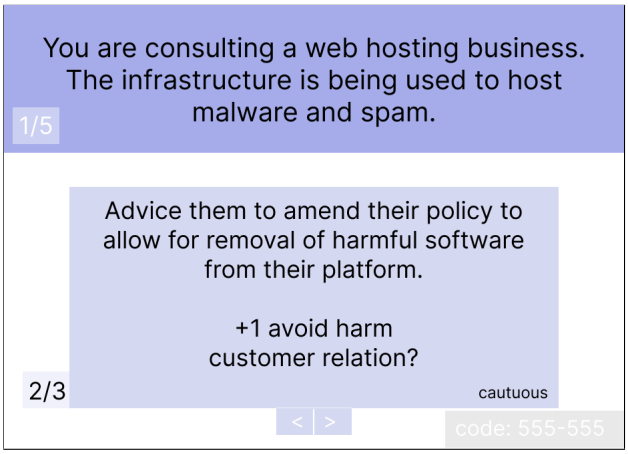


Figure 2: Consultant Tycoon story introduction

Figure 2 explains what role the players have in the game and in what context the players encounter the dilemmas they have to act on.

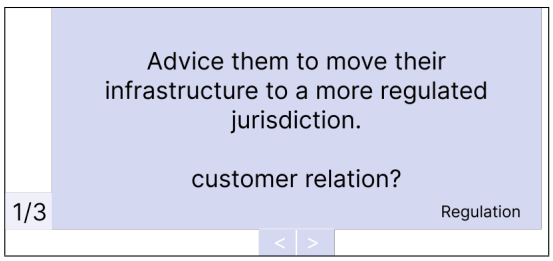


(a) Description of dilemma 1

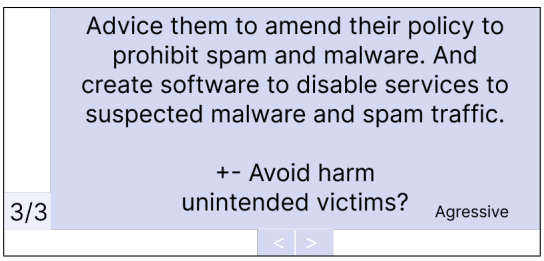


(b) Dilemma 1 main screen

Figure 3: Presentation of dilemma 1



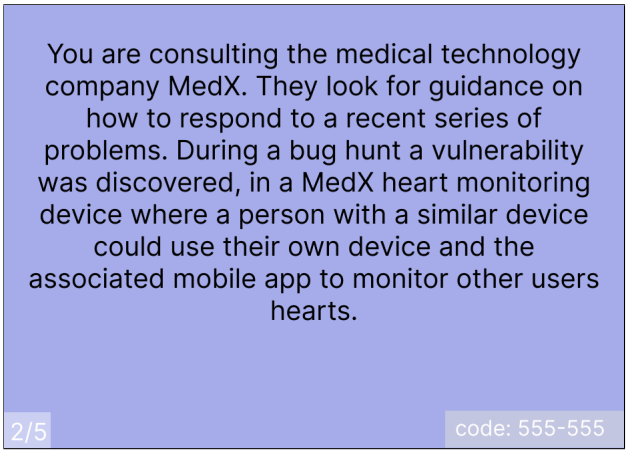
(a) option 1 for player action



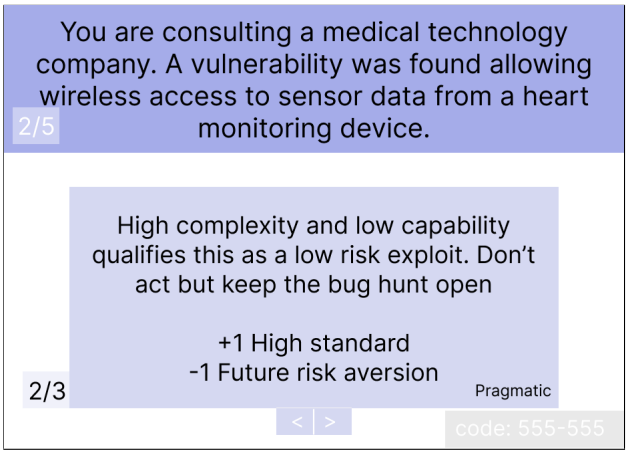
(b) Option 3 for player action

Figure 4: Additional options for dilemma 1

The dilemma presented in Figure 3 and 4 is inspired by the issues described in Section 4.1.1.

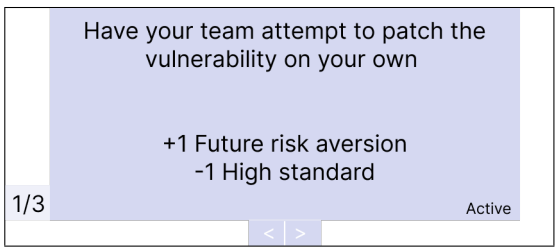


(a) Description of dilemma 2

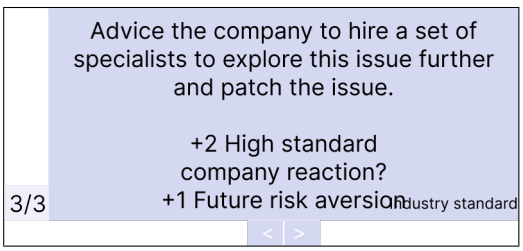


(b) Dilemma 2 main screen

Figure 5: Presentation of dilemma 2



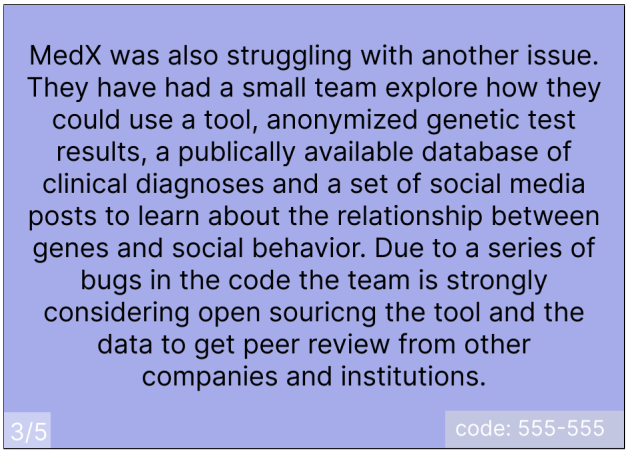
(a) Option 1 for player action



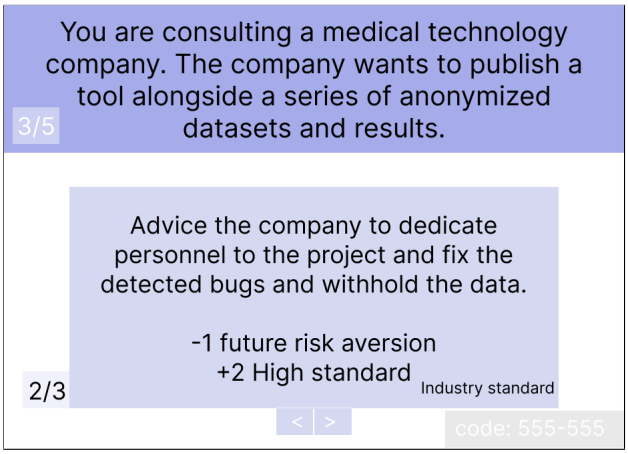
(b) Option 3 for player action

Figure 6: Additional options for dilemma 2

The dilemma presented in Figure 5 and 6 is inspired by the issues described in Section 4.1.3.

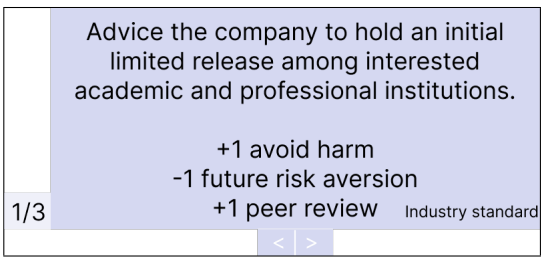


(a) Description of dilemma 3

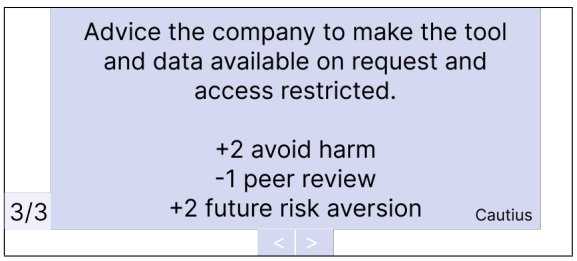


(b) Dilemma 3 main screen

Figure 7: Presentation of dilemma 3



(a) Option 1 for player action



(b) Option 3 for player action

Figure 8: Additional options for dilemma 3

The dilemma presented in Figure 7 and 8 is inspired by the issues described in Section 4.1.2.

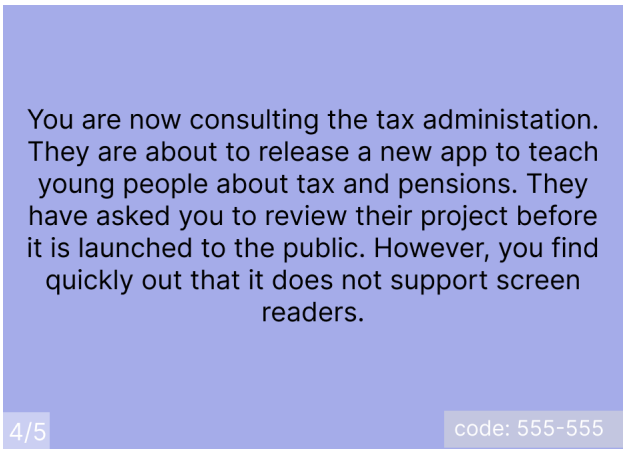
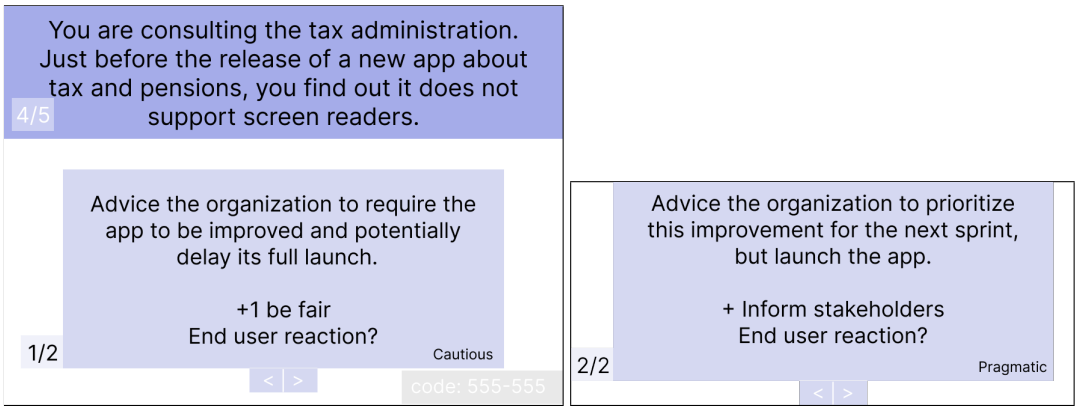


Figure 9: Description of dilemma 4



(a) Main screen for dilemma 4 (b) Option 2 for player action

Figure 10: Case screen for dilemma 4

The dilemma presented in Figure 9 and 10 is based on the issues described in Section 4.1.5.

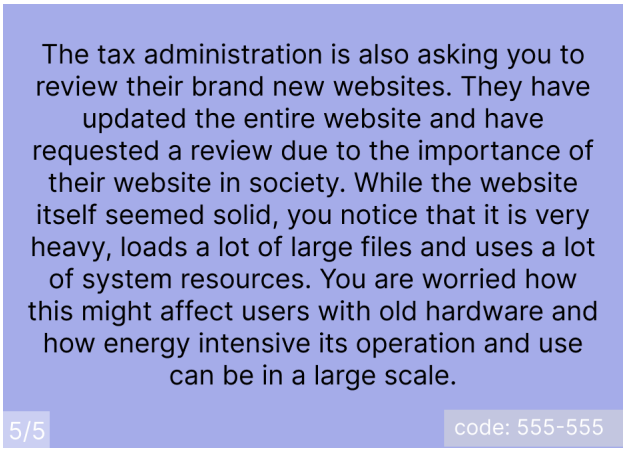
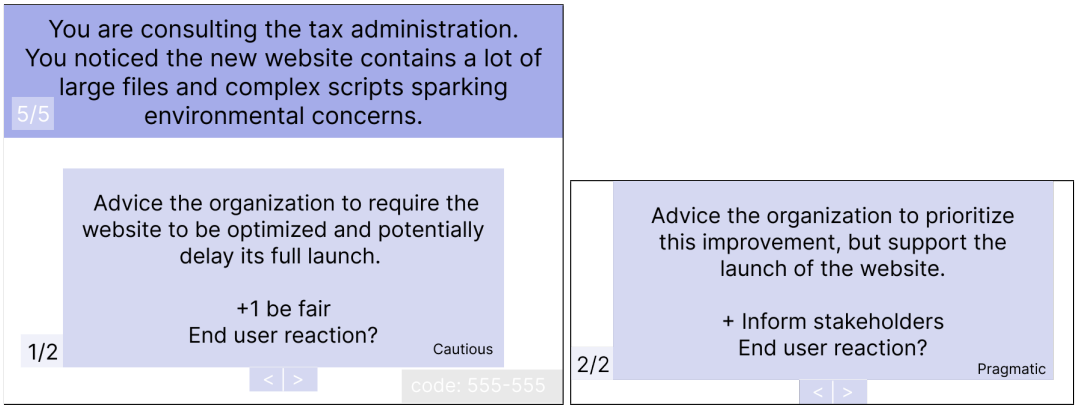


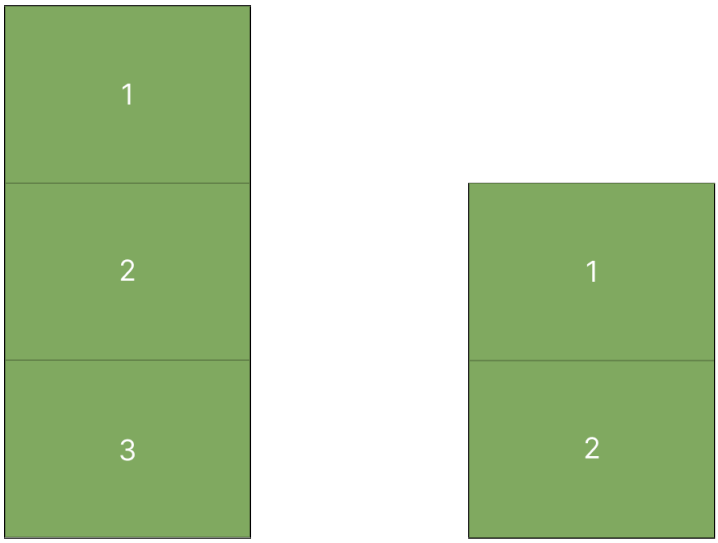
Figure 11: Description of dilemma 5



(a) Main screen for dilemma 5 (b) Option 2 for player action

Figure 12: Case screen for dilemma 5

The dilemma presented in Figure 11 and 12 is based on the issues described in Section 4.1.4.



(a) Voting screen with three options (b) Voting screen with two options

Figure 13: Phone voting screens

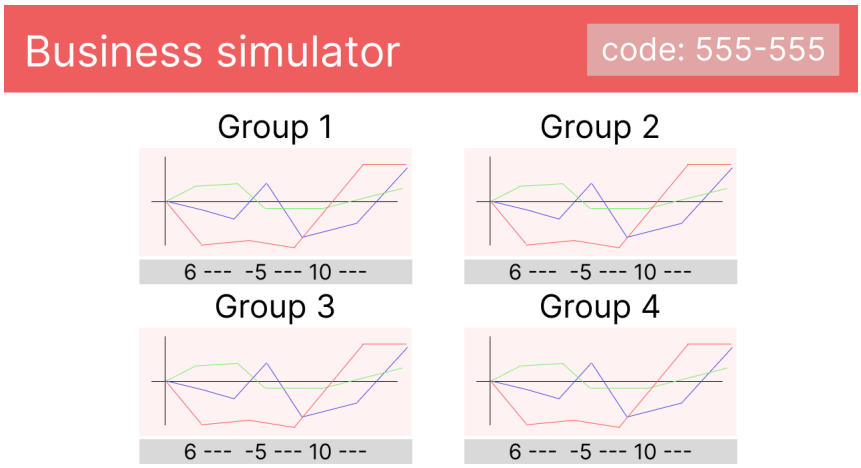


Figure 14: End screen of the play session

Figure 14 shows the end screen of the play session. This will be shoin in the classroom setting to potentially fasiliate for further discussion in a larger classroom setting. After the final group interview discussed in chapter 7, the team realised that it could be more beneficial to use bar graphs to show the data collected from the dilemmas. This is due to how the game mainly focuses on what priorities the players make in their decisions. This is in contrast to a measurement of a value over time or any other comparison between two specific factors, which is implied in a line graph like the one in Figure 14.

D NSD application

Sikt

Notification form / Game for facilitating ethical education for computer science students / Export

Notification Form

Reference number
306217

Which personal data will be processed?

- Name (also with signature/written consent)
- Sound recordings of people
- Background data that can identify a person

Describe which background data that can identify individual persons you will be processing

Field of study and faculty for professors, and year of study for studends. We would like to record audio from the interviews and user tests for record keeping and later analysis. Name for consent.

Project information

Project title

Game for facilitating ethical education for computer science students

Project description

In this project want to do research on how a game could improve the ethical education for computer science students. We want to conduct user tests to evaluate prototypes, surveys to gather relavant data on the opinions of computer science students, and interviews with students, game experts and professors regarding prototypes and thoughts regarding current ethical discussions and education.

Explain why it is necessary to process personal data in the project

Name is neccessary for signature in consent form, audio recording is neccessary for capturing details that are not transferable to a written transcription. Background information in the form of study program, year of study or faculty is recorded to put their responses into perspective and is needed as a qualifying or disqualifying factor in user testing.

External funding
Ikke utfyllt
Type of project
Student project, Master's thesis

Contact information, student
Jørgen Nummedal Sveberg, jorgen.n.sveberg@gmail.com, tlf: 46945494

Data controller

Data controller (institution responsible for the project)
Norges teknisk-naturvitenskapelige universitet / Fakultet for informasjonsteknologi og elektroteknikk (IE) / Institutt for datateknologi og informatikk

Project leader (academic employee/supervisor or PhD candidate)
Monica Divitini, divitini@ntnu.no, tlf: 91897790

Will the responsibility of the data controller be shared with other institutions (joint data controllers)?
No

Sample 1

Describe the sample

Computer science student

Describe how you will recruit or select the sample

The participants are recruited through contact with the student organizations within the department of computer science.

Age
18 - 30

Personal data relating to sample 1

- Name (also with signature/written consent)
- Sound recordings of people
- Background data that can identify a person

How will you collect data relating to sample 1?

Personal interview

Attachment

Interview Guide.pdf

Legal basis for processing general categories of personal data
Consent (General Data Protection Regulation art. 6 nr. 1 a)

Group interview

Attachment

Interview Guide.pdf

Legal basis for processing general categories of personal data
Consent (General Data Protection Regulation art. 6 nr. 1 a)

Information for sample 1

Will you inform the sample about the processing of their personal data?
Yes

How?
Written information (on paper or electronically)

Information letter

information_letter_students.docx.pdf

Sample 2

Describe the sample

Game developers, designers and experts

Describe how you will recruit or select the sample

Will be recruited through personal network and contact with game enthusiast organizations. Qualifying factor will be participant in a game enthusiast organisation.

Age
18 - 60

Personal data relating to sample 2

- Name (also with signature/written consent)
- Sound recordings of people
- Background data that can identify a person

How will you collect data relating to sample 2?

Personal interview

Attachment

Interview Guide Game expert.pdf

Legal basis for processing general categories of personal data
Consent (General Data Protection Regulation art. 6 nr. 1 a)

Information for sample 2

Will you inform the sample about the processing of their personal data?
Yes

How?
Written information (on paper or electronically)

Information letter

information_letter_game_expert.pdf

Sample 3

Describe the sample

Professors of computer science and professors of ethics

Describe how you will recruit or select the sample

The participants are recruited through contact with various organisations within NTNU.

Age
19 - 70

Personal data relating to sample 3

- Name (also with signature/written consent)
- Sound recordings of people
- Background data that can identify a person

How will you collect data relating to sample 3?

Personal interview

Attachment

Interview Guide professor.pdf

Legal basis for processing general categories of personal data
Consent (General Data Protection Regulation art. 6 nr. 1 a)

Group interview

Attachment

Interview Guide professor.pdf

Legal basis for processing general categories of personal data
Consent (General Data Protection Regulation art. 6 nr. 1 a)

Information for sample 3

Will you inform the sample about the processing of their personal data?
Yes

How?
Written information (on paper or electronically)

Information letter

information_letter_professor.pdf

Third Persons

Will you be processing data relating to third persons?
No

Documentation

How will consent be documented?

- Manually (on paper)
- Electronically (email, e-form, digital signature)

How can consent be withdrawn?

Data subjects can withdraw consent through email.

How can data subjects get access to their personal data or have their personal data corrected or deleted?

Data subjects can acess their personal data through email.

Total number of data subjects in the project
1-99

Approvals

Will you obtain any of the following approvals or permits for the project?
Ikke utfyllt

Processing

Where will the personal data be processed?
- Computer belonging to the data controller
- External service or network (data processor)

Who will be processing/have access to the collected personal data?
- Project leader
- Student (student project)
- Data processor

Which data processor will be processing/have access to the collected personal data?

OneDrive NTNU

Will the collected personal data be transferred/made available to a third country or international organisation outside the EU/EEA?
No

Information Security

Will directly identifiable data be stored separately from the rest of the collected data (e.g. in a scrambling key)?
Yes

Which technical and practical measures will be used to secure the personal data?
- Personal data will be anonymised as soon as no longer needed
- Restricted access

Duration of processing

Project period
30.01.2023 - 26.06.2023

What happens to the data at the end of the project?
All data will be deleted (deleting raw data)

Will the data subjects be identifiable (directly or indirectly) in the thesis/publications from the project?
No

Additional information

The project is performed by two students. Here is the information from the second student:
Name: Hjalti Percy Casimis Hjaltason
Email: hjaltipeh@gmail.com
Phone: 40173696

E Information letter for professors

Are you interested in taking part in the research project

"Game for facilitating ethical education for computer science students"?

Purpose of the project
You are invited to participate in a research project where the main purpose is to create and analyse a game to facilitate the education of professional ethics for computer scientists. In Europe there has been an interest in ethical education and guidelines among scientists. Recently the media has also put a spotlight on ethical issues specific to the field of computer science. This project aims to develop a game to aid in the ethics education of students within this field.

The project is done in the context of the masters project of Hjalti P. C. Hjaltason and Jørgen N. Sveberg. The masters project is done under the Department of Computer Science at NTNU. The project started in late January 2023 and ends in late June 2023. The information gathered will not be used for other purposes than this masters project.

Which institution is responsible for the research project?
The Department of Computer Science in NTNU is responsible for the project.

Why are you being asked to participate?
You are asked to participate because you are a professor at a relevant institute or organisation within NTNU. This gives you an educational and professional background that is highly relevant to this project, as it aims to produce and evaluate a tool to aid in ethics education for computer science students. Your name came up based on your activity in a relevant organisation within NTNU. Your contact information was collected through a personal network or contact with a relevant organisation.

What does participation involve for you?
If you choose to participate in this project, it will require your practical use of the prototype as well as participation in an interview. Your interaction with the prototype can be of an unpredictable length, but the prototype will be designed with maximum 30 minutes of play in mind. The interview will take about 30 minutes of your time.

During the interview you will be asked some questions regarding your studies to ensure that you qualify for participation. Then the interview will consist of questions regarding your experience using the prototype and some questions regarding learning experiences from interaction with the prototype. The use of the prototype will not itself record any data, but some data might be collected by note taking by researchers present. During the interview the audio will be recorded and notes will get taken.

Participation is voluntary
Participation in the project is voluntary. If you chose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be deleted.

There will be no negative consequences for you if you choose not to participate or later decide to withdraw.

Your personal privacy – how we will store and use your personal data
We will only use your personal data for the purposes specified here and we will process your personal data in accordance with data protection legislation (the GDPR). The project team will have access to the audio recordings and notes from the interviews and prototype play sessions. These will be transcribed and anonymised. Each session will be marked by a code to anonymise the participant(s). In case multiple participants partake in the same session an alias will be applied to the participant(s) to ensure anonymity. The data will be stored in a password protected server at NTNU.

The project supervisor will have access to the anonymised data.

What will happen to your personal data at the end of the research project?
The planned end date of the project is 27th of June 2023. In case the information is used in the context of a publication within the academic environment, the participant who generated the data will be anonymised and will not be individually recognisable. All remaining data will be deleted after the end of the project.

Your rights
So long as you can be identified in the collected data, you have the right to:

- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Norwegian Data Protection Authority regarding the processing of your personal data

What gives us the right to process your personal data?
We will process your personal data based on your consent.

Based on an agreement with NTNU, the Data Protection Services of Sikt – Norwegian Agency for Shared Services in Education and Research has assessed that the processing of personal data in this project meets requirements in data protection legislation.

Where can I find out more?
If you have questions about the project, or want to exercise your rights, contact:

- Department of Computer Science at NTNU via supervisor Monica Divitini.
- Our Data Protection Officer: Thomas Helgesen, 93079038, thomas.helgesen@ntnu.no

If you have questions about how data protection has been assessed in this project by Sikt, contact:

- email: (personverntjenester@sikt.no) or by telephone: +47 73 98 40 40.

Yours sincerely,

Monica Divitini
(Researcher/supervisor)

Hjalti P. C. Hjaltason and Jørgen N. Sveberg

Consent form

I have received and understood information about the project **Game for facilitating ethical education for computer science students** and have been given the opportunity to ask questions. I give consent:

- □ to participate in interview

I give consent for my personal data to be processed until the end of the project.

(Signed by participant, date)

F Initial interview guide for professors

Interview Guide

Interviews are performed in the period February to June in physical meetings. The main topic will be the users' experience with our prototypes and software engineering ethics, supplemented by some information regarding the participants' backgrounds to confirm eligibility for our project.

Examples of questions to be asked:
Eligibility and background:

- What organisation do you work in?
- Could you describe your experience with ethics during your work?
- Are there any sets of computer ethical issues you find particularly interesting?

Regarding prototype:

- Did you find the game prototype entertaining?
- Would you find this prototype an interesting activity as part of an ethics or software engineering course?
- Did you find the ethical issues in the prototype relevant to your work?
- Do you feel these ethical issues were represented well?
- How did you categorise the events you had to handle?
    - Were these events identifiable as ethical cases?

G Information letter for game experts

Are you interested in taking part in the research project

***"Game for facilitating ethical education for computer science students"*?**

Purpose of the project
You are invited to participate in a research project where the main purpose is to create and analyse a game to facilitate the education of professional ethics for computer scientists. In Europe there has been an interest in ethical education and guidelines among scientists. Recently the media has also put a spotlight on ethical issues specific to the field of computer science. This project aims to develop a game to aid in the ethics education of students within this field.

The project is done in the context of the masters project of Hjalti P. C. Hjaltason and Jørgen N. Sveberg. The masters project is done under the Department of Computer Science at NTNU. The project started in late January 2023 and ends in late June 2023. The information gathered will not be used for other purposes than this masters project.

Which institution is responsible for the research project?
The Department of Computer Science in NTNU is responsible for the project.

Why are you being asked to participate?
You are asked to participate because you are an expert within games in a relevant organisation. This gives you a background that is highly relevant for this project, as it aims to produce and evaluate a serious game to aid in ethics education for computer science students. Your name came up based on your participation in a relevant organisation. Your contact information was collected through a personal network and contact with a relevant organisation.

What does participation involve for you?
If you choose to participate in this project, it will require your practical use of the prototype as well as participation in an interview. Your interaction with the prototype can be of an unpredictable length, but the prototype will be designed with maximum 30 minutes of play in mind. The interview will take about 30 minutes of your time.

During the interview you will be asked some questions regarding your experience with games to ensure that you qualify for participation. Then the interview will consist of questions regarding your experience using the prototype and some questions regarding learning experiences from interaction with the prototype. The use of the prototype will not itself record any data, but some data might be collected by note taking by researchers present. During the interview the audio will be recorded and notes will be taken.

Participation is voluntary
Participation in the project is voluntary. If you chose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be deleted.

There will be no negative consequences for you if you choose not to participate or later decide to withdraw.

Your personal privacy – how we will store and use your personal data
We will only use your personal data for the purposes specified here and we will process your personal data in accordance with data protection legislation (the GDPR). The project team will have access to the audio recordings and notes from the interviews and prototype play sessions. These will be transcribed and anonymised. Each session will be marked by a code to anonymise the participant(s). In case multiple participants partake in the same session an alias will be applied to the participant(s) to ensure anonymity. The data will be stored in a password protected server at NTNU.

The project supervisor will have access to the anonymised data.

What will happen to your personal data at the end of the research project?
The planned end date of the project is 27th of June 2023. In case the information is used in the context of a publication within the academic environment, the participant who generated the data will be anonymised and will not be individually recognisable. All remaining data will be deleted after the end of the project.

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- email: (personverntjenester@sikt.no) or by telephone: +47 73 98 40 40.

Yours sincerely,

Monica Divitini
(Researcher/supervisor)

Hjalti P. C. Hjaltason and Jørgen N. Sveberg

Consent form

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- □ to participate in interview

I give consent for my personal data to be processed until the end of the project.

(Signed by participant, date)

H Initial interview guide for game expert

Interview Guide

Interviews are performed in the period February to June in physical meetings. The main topic will be the users' experience with our prototypes and software engineering ethics, supplemented by some information regarding the participants' backgrounds to confirm eligibility for our project.

Examples of questions to be asked:
Eligibility and background:

- What parts of game development and design are you experienced with?
- How long have you been involved in game development?

Regarding prototype:

- Did you find the game prototype entertaining?
- Would you find this prototype an interesting activity as part of an ethics or software engineering course?
- How did you experience the game UI?
- Do you find any aspects of the gameplay loop lacking?
- Do you have any recommendations regarding the direction of the game development?
- How did you categorise the events you had to handle?
    - Were these events identifiable as ethical cases?

I Information letter for students

Are you interested in taking part in the research project

***"Game for facilitating ethical education for computer science students"*?**

Purpose of the project
You are invited to participate in a research project where the main purpose is to create and analyse a game to facilitate the education of professional ethics for computer scientists. In Europe there has been an interest in ethical education and guidelines among scientists. Recently the media has also put a spotlight on ethical issues specific to the field of computer science. This project aims to develop a game to aid in the ethics education of students within this field.

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Which institution is responsible for the research project?
The Department of Computer Science in NTNU is responsible for the project.

Why are you being asked to participate?
You are asked to participate because you are a student at the department of computer science. This gives you an educational background that is highly relevant to this project, as it aims to produce and evaluate a tool to aid in ethics education for computer science students. Your name came up based on your participation in a study programme in the Department of Computer Science. Your contact information was collected through a personal network.

What does participation involve for you?
If you choose to participate in this project, it will require your practical use of the prototype as well as participation in an interview. Your interaction with the prototype can be of an unpredictable length, but the prototype will be designed with maximum 30 minutes of play in mind. The interview will take about 30 minutes of your time.

During the interview you will be asked some questions regarding your studies to ensure that you qualify for participation. Then the interview will consist of questions regarding your experience using the prototype and some questions regarding learning experiences from interaction with the prototype. The use of the prototype will not itself record any data, but some data might be collected by note taking by researchers present. During the interview the audio will be recorded and notes will get taken.

Participation is voluntary
Participation in the project is voluntary. If you chose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be deleted. There will be no negative consequences for you if you choose not to participate or later decide to withdraw.

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- email: (personverntjenester@sikt.no) or by telephone: +47 73 98 40 40.

Yours sincerely,

Monica Divitini

(Researcher/supervisor)

Hjalti P. C. Hjaltason and Jørgen N. Sveberg

Consent form

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- □ to participate in interview

I give consent for my personal data to be processed until the end of the project.

(Signed by participant, date)

J Initial interview guide for students

Interview Guide

Interviews are performed in the period February to June in physical meetings. The main topic will be the users' experience with our prototypes and software engineering ethics, supplemented by some information regarding the participants' backgrounds to confirm eligibility for our project.

Examples of questions to be asked:
Eligibility and background:

- What study program are you in?
- What year of study are you in?
- Could you describe your experience with ethics education during your studies?

Regarding prototype:

- Did you find the game prototype entertaining?
- Would you find this prototype an interesting activity as part of an ethics or software engineering course?
- Did you find the ethical issues in the prototype relevant to your studies and current/future work?
- How did you categorise the events you had to handle?
    - Were these events identifiable as ethical cases?

K Game expert interview guide

Intro
Vi skriver en master om bruk av spill i etikkundervisning for data-studenter, og ønsker å ha en diskusjon angående dine meninger rundt konseptene våre.

Spill
Har dere noen tanker eller rutiner for å evaluere spillkonsepter?
Hvordan evaluerer dere spillene dere skaper?
Har du laget noen spill med etiske problemstillinger for spilleren?
- Hvilke aspekter mener du er en effektiv måte å få en spiller til å bry seg om en etisk problemstilling?
- Hvilke aspekter mener du minker en spillers motivasjon til å bry seg om en etisk problemstilling?

Hva tenker du er ødeleggende for en spillers innlevelse?

Har du noe erfaring med spill i undervisning?
- Hvilke aspekter hadde en positiv påvirkning på undervisningen?
- Hvilke aspekter hadde en negativ påvirkning på undervisningen?

Mener du spill har en plass i undervisning?
Har du utviklet et spill for bruk i undervisning tidligere?

Konsept

Konseptet går ut på at vi har to spill ment for å brukes i et fag om etikk innen IT eller som en del av en etisk modul i et IT fag. Hvor studentene vil lære om forskjellige aspekter ved temaet. Innen denne masteren har vi prototypet storyboards av to spill, ment som å fungere som et “proof of concept” av denne ideen.

Det første er et singleplayer konsulenthus tycoon spill der spilleren må styre et lite konsulenthus, og må balansere å holde selskapet levedyktig opp mot selskapets rykte. Spillet vil fungere som en introduksjon til reelle problemstillinger gjennom teoretiske scenarier.

Det andre spillet er et kortspill der spillere må idemyldre startup bedrifter og forsvare seg overfor en investor som vil vurdere bedriftene innen gjennomførbarhet, økonomisk levedyktighet, men aller viktigst etisk forsvarlighet. Dette er ment til å utsette spillerne for kritikk og diskusjon for å dyrke kritiske etiske ferdigheter.

Spørsmål om konseptene:

Hva er dine første tanker om konseptet og spillene individuelt?
Hvilke endringer virker mest åpenbare for deg?
Hvilke aspekter føler du negativt påvirker ditt ønske om å bruke et slikt produkt?
Hvilke aspekter føler du positivt påvirker ditt ønske om å bruke et slikt produkt?
Hvilke aspekter ved spillet vil være kritiske for at du skulle brukt et slikt produkt i undervisning?

L Computer science professor interview guide

Intro
Vi skriver en master om bruk av spill i etisk utdanning av data-studenter, og ønsker å ha en diskusjon angående dine meninger rundt dette.

Spørsmål rundt etisk utdanning for data-studenter
Føler du at data-studenter fra NTNU får tilstrekkelig opplæring innen yrkesrelevant etikk?
Hvilke etiske problemstillinger eller ferdigheter, om noen, mener du trenger grundigere opplæring? Hvor finner du utdanningen spesielt manglende?

Har du noen andre kommentarer om den etiske undervisningen data-studenter får på NTNU?

Har du noe erfaring med bruk av spill i undervisning?
Hvis så, hvilke aspekter hadde en positiv påvirkning på undervisningen?
Hvis så, hvilke aspekter hadde en negativ påvirkning på undervisningen?
Hvis ikke, er det noe som har fått deg til å unngå bruk av spill i undervisning?

Hvilke krav ville du satt til et spill for at du hadde vurdert å bruke det i undervisning?
Teknisk, Format, plattform
Innhold, Sjanger, Bruksområde

Spill konsept beskrivelse:
Konseptet vi har kommet fram til er en samling med to spill som er ment for å brukes i et fag om etikk innen IT eller som en del av et etisk modul i et IT fag, hvor studentene vil lære om forskjellige aspekter ved temet. Innen denne masteren har vi prototypet storyboards av to spill, ment som å fungere som et “proof of concept” av denne ideen.

Det første er et singleplayer konsulenthus tycoon spill der spilleren må styre et lite konsulenthus, og må balansere å holde selskapet levedyktig opp mot selskapets rykte. Spillet vil fungere som en introduksjon til reelle problemstillinger gjennom teoretiske scenarier.

Det andre spillet er et kortspill der spillere må idemyldre startup bedrifter og forsvare seg overfor en investor som vil vurdere bedriftene innen gjennomførbarhet, økonomisk levedyktighet, men aller viktigst etisk forsvarlighet. Dette er ment til å utsette spillerne for kritikk og diskusjon for å dyrke kritiske etiske ferdigheter.

Spørsmål om konseptet:

Hva er dine første tanker om konseptet og spillene individuelt?

Hvilke aspekter føler du negativt påvirker ditt ønske om å bruke et slikt produkt?
Hvilke aspekter føler du positivt påvirker ditt ønske om å bruke et slikt produkt?
Hvilke aspekter ved spillet vil være kritiske for at du skulle brukt et slikt produkt i undervisning?

M Ethics professor interview guide

Intro
Vi skriver en master om bruk av spill i etisk utdanning av data-studenter, og ønsker å ha en diskusjon angående dine meninger rundt dette.

Etikk bredere

Hvilke ferdigheter tenker du er viktigst å lære for datastudenter?
Hvis du hadde vert ansvarlig for en etisk modul i et datafag, hvordan ville du strukturert dette?

Spill bredere

Har du noe erfaring med bruk av spill i undervisning?
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- Hvis ikke, er det noe som har fått deg til å unngå bruk av spill i undervisning?

Hvilke krav ville du satt til et spill for at du hadde vurdert å bruke det i undervisning?
- Teknisk, Format, plattform
- Innhold, Sjanger, Bruksområde

Konsept

Konseptet vi har kommet fram til er en samling med to spill som er ment for å brukes i et fag om etikk innen IT eller som en del av en etisk modul i et IT fag. Hvor studentene vil lære om forskjellige aspekter ved tema. Innen denne masteren har vi prototypet storyboards av to spill, ment som å fungere som et “proof of concept” av denne ideen.

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Hvilke aspekter ved spillet vil være kritiske for at du skulle brukt et slikt produkt i undervisning?

N Student interview guide iteration 2

Intro

Vi skriver en master om bruk av spill i etikk undervisning av data-studenter, og ønsker å ha en diskusjon angående dine meninger rundt dette og førsteinntrykk av konseptene våre.

Bredere spørsmål

Hvordan har etikk vært en del av utdanningen din?
Har du hatt noe fokus på etikk eller stakeholders og konsekvenser i noen tekniske emner?

Har du tidligere brukt spill som et læringsverktøy mens du har studert?
Har du noen tanker rundt bruk av spill til undervisning?

Konsept Consultant Tycoon

Konseptet går ut på at vi har to spill ment for å brukes i et fag om etikk innen IT eller som en del av en etisk modul i et IT fag. Hvor studentene vil lære steg for steg om forskjellige aspekter ved tema. Innen denne masteren har vi prototypet storyboards av to spill, ment som å fungere som et "proof of concept" av denne ideen. Den første ideen har gjennomgått noen store endringer vi er nysgjerrig på dine tanker om.

Den første versjonen er et singleplayer konsulenthus tycoon spill der spilleren må styre et lite konsulenthus, og må balansere å holde selskapet levedyktig opp mot selskapets rykte. Spillet vil fungere som en introduksjon til reelle problemstillinger gjennom teoretiske scenarier innbakt i en simulasjon av en hel bedrift.
Den andre versjonen av dette spillet er en flerspilleropplevelse hvor en gruppe studenter kobler seg til en felles session. Her har dere samme historie, men dropper simulasjonen av bedriften. Hovedfokuset i dette konseptet er å håndtere etiske dilemmaer. For hvert dilemma får dere en rekke mulige alternativer som dere må diskutere mellom dere selv for å bygge konsensus, flertallet bestemmer hvilken handling som blir begått.

Spørsmål
Har du noen tanker om disse to versjonene?
Hva tenker du om å fjerne bedriftsimulasjonen for å gjøre spillet flerspillervennlig?
Hadde du foretrukket å spille et slikt spill sammen med medelever?

Konsept Startupsuperfight
Dette er et konkurransedrevet kortspill. En spiller tar på seg rollen som kunde, trekker et kort fra en "persona" bunke og tar på seg rollen beskrevet. Resten av spillerne skal prøve å utvikle en rask startup idé, som kan tilfredsstille behovet til "personaen". Spillerne skal videre anvende kritikkkort for å vise noen måter startup ideen kan være problematisk. Dette er ment til å utsette spillerne for kritikk og diskusjon som en del av etikkundervisningen.

Spørsmål
Har du noen tanker om dette konseptet?
Har du spilt noen lignende spill?

O Group interview guide

Intro

Vi skriver en master om utvikling av spill i etikkundervisning for data-studenter, og har derfor invitert dere til et intervju og brukertest, slik at vi kan få noen førsteinntrykk og erfaringer angående bruk av konseptene våre.

Vi har utviklet to korte prototyper, som begge er spill for flere spillere, men som er basert på to forskjellige måter å gjennomføre dette. Spesifikt samarbeid og konkurranse som måter å fasilitere for diskusjon.

Startup superfight

Dette er et konkurransedrevet kortspill. En spiller tar på seg rollen som kunde, trekker et kort fra "persona" bunken og leser det høyt for alle. Resten av dere prøver å utvikle en rask startup idé, som kan tilfredsstille dette behovet. Dette gjøres ved at dere trekker tre kort fra "technology" bunken og tre kort fra weakness bunken. Dere kan bruke en eller flere "technology" kort til å lage en ide. Denne presenteres ved at dere legger kortene dere bruker på boret sånn at alle kan se og så finner dere opp en historie eller en annen beskrivelse av hvordan denne kan hjelpe personaen med problemet deres. Når begge har gjort dette kan dere tenke over hva slags svakheter eller potensielle problemer som kan oppstå. Dette gjør dere gjennom å bruke weakness kortene deres, som dere kan bruke til å lage en historie som beskriver hva slags problemer dere har funnet med motstanderens teknologi, denne kritikken er alltid sann. Deretter kan dere komme med noen forslag eller ideer på hvordan denne svakheten kan utbedres eller avbøtes. Deretter kan persona'en velge den beste ideen. Vinneren tar "persona" kortet og bruker det som et poeng. Førstemann til tre poeng vinner.

Post-game intervju
Kjente dere igjen spillet som inspirerte prototypen?
Hvordan tenker dere at spillet og konkurransen drev samtalen framover?
Har dere noen tanker rundt spillet generelt?
Følte dere at dere fikk utforsket noen problemstillinger?

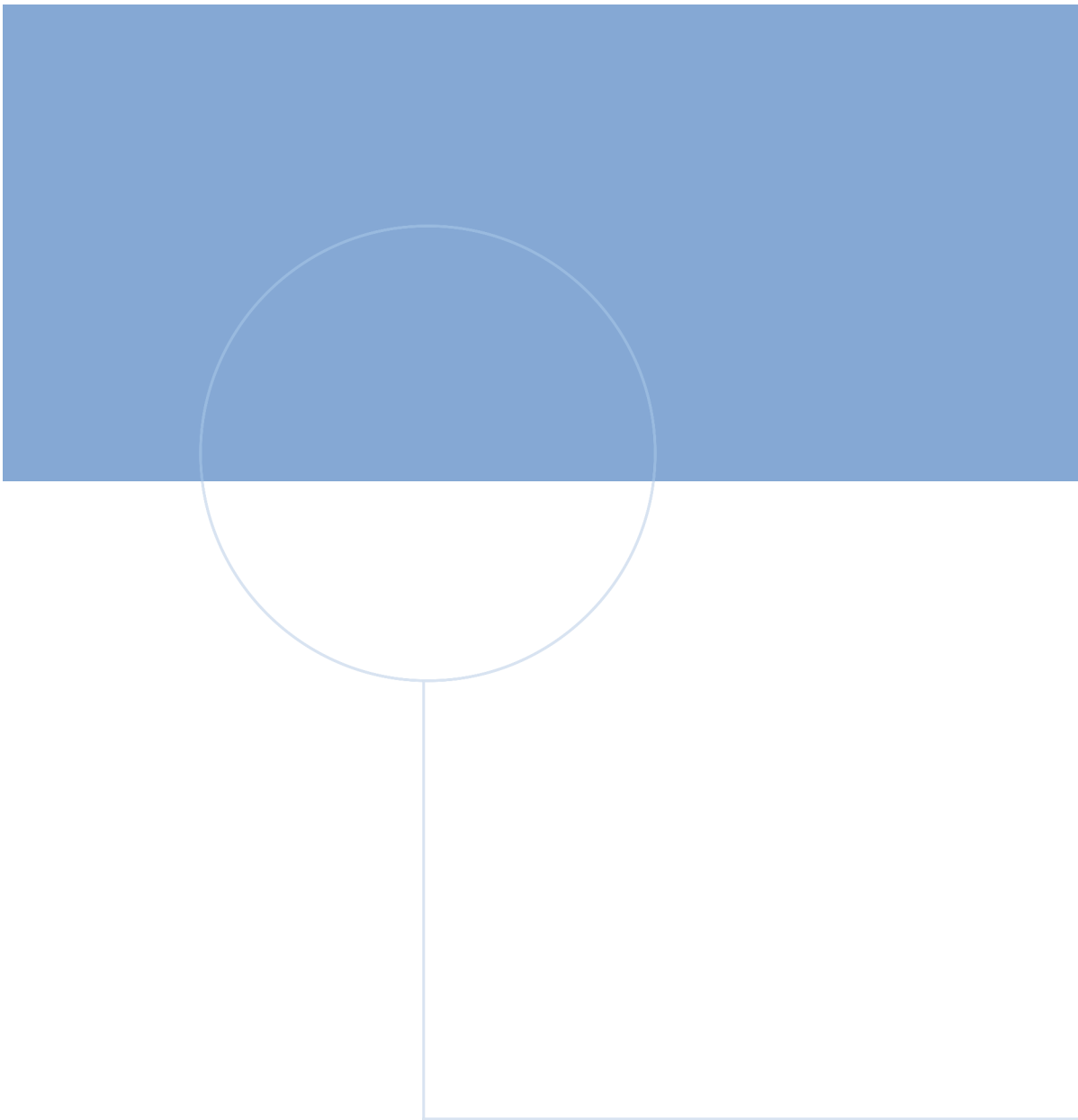
Consultant tycoon

Dette er i hovedsak et narrativ-drevet spill. Jeg flytter dere mellom forskjellige skjermer når dere sier hva dere ønsker å gjøre. Når dere ser skjermene som beskriver etiske dilemmaer kan dere stemme med å bruke de små kortene dere har fått. På disse kan dere stemme med å bruke pennene jeg har lagt foran dere til å skrive ned nummeret på dilemmaet dere svarer på, i feltet som korresponderer til valgmuligheten dere velger. Dere kan deretter vise meg svarene deres slik at vi kan gå videre.

Post-game intervju

Minnet spillet dere om noe dere har vært borti før?
Har dere noen tanker rundt spillet generelt?
Hva tenker dere om at spillet var så drevet av narrativ?

Hva hadde dere tenkt om jeg hadde fortalt dere at alle dilemmaene er basert på reelle caser og pågående debatter?
Har dere noen tanker om hvordan casene var presentert, kunne noe vært bedre?
Det var ikke inkludert i denne prototypen, men konseptet inneholder konsekvensskjermer som påvirkes av terningkast utifra valgene deres, hvordan tenker dere at dette hadde påvirket opplevelsen?
Hvordan føler dere at det konkurransedrevne spillet dere spilte istad fasiliterte for diskusjon opp mot samarbeidsspillet dere nettopp spilte? Følte dere noen forskjeller?



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