Group 6 – Risk Analysis and Safety Engineering

Strategy

We started with the initial brainstorming in the first class, and set up a first meeting a week later. In total we met 5 or 6 times for 2-3 hours and worked individually on different parts in between. At first we discussed what the chapter was about and then threw around ideas for the main concept. We needed an example of a new technology with clear benefits and risks. We were interested in doing something to do with future tech and we talked seriously about driverless cars, but felt that since it had been done in the MOOC we should do something else. We also thought about what a good lecture would be like given that we were second and had half the time of other groups. Timing was critical! We realized that we needed a compact and interaction-based presentation to make sure it was engaging for the audience. The idea of exploring various paradoxes, such as the St. Petersburg paradox, which are inherent to human thought when processing risk, came to mind, however we felt we didn't have the time. After three meetings or so it was suggested that we might do something with GMOs or gene manipulation and the movie Gattaca came up.

Method

We split up the different sections and chapters based roughly on fair workloads and preferences. Without going into too much detail and acknowledging that everyone worked on everything, the initial breakdown was as follows:

- Nelson - Safety Theory
- Jouke and Elias - Risky Choices
- Anna and Niklas - Interaction/Roleplay

After hearing feedback, we decided to use the theme of Gattaca for every part of the presentation, but we were not sure how to do it. We also thought hard about how we could make risky choices interesting, given the short amount of time we had and eventually decided to use candy, in A/B games. We thought about the theory, how it was explained and what we found interesting or missing. During the second part of the course we continued to work well together, but each person was in charge of sections roughly like this:

- Niklas - CBA Theory and Value of Humans
- Elias & Jouke - Human Nature & Risk Game
- Anna – Discussion Printouts and Structure
- Nelson – Safety Engineering and Risk Theory

We met a week before the presentation and designed the group interaction based on what Anna had put together. We told the class to watch the movie so that they might be able to better contribute in the discussion. We then had an open discussion about which stakeholders we should consider and picked our six favorites. We used a whiteboard to make a bullet point list of different aspects of each stakeholder to help in the discussion with students, if the topics didn't come up naturally. After that each person picked a stakeholder they wanted to represent in leading the discussions. Eventually, everyone made slides individually and sent them to Jouke and Niklas, who put them together. We met one last time to practice the presentation, time it and iron out any issues. We decided last minute, that we were a company active in gene research, as our main approach. We needed costumes: suits for Erasmus, lab coats for Delft. Niklas and Jouke worked on the logo, while Anna and Elias worked on the coats.

Presentation Outline

Before the start of the lecture, everyone was handed asked to watch the film Gattaca, which explores the ethical and moral issues and dilemmas pertaining to a society in which gene manipulation, selection and/or eugenics are commonplace. We chose to do this intentionally to get the students in the mood and make them think about the subject.

Right before the start of the lecture, an "Insurance Form" was handed out to the students, in which they could select certain diseases/problems to be eliminated from their gene code, for varying prices (expressed in amount of monthly incomes). This form helped set the mood and can be found in the added presentation material.

Moreover, we dressed in either a suit (Niklas and Jouke) or a labcoat (Elias, Nelson, Anna) and pretended to be managers and researchers from Genecorp, a company that develops gene manipulation technology. We had worked in agriculture before, on crops and livestock, but were looking to innovate at diversify into humans. We acted as if we were in the city Gattaca in the year 2035 where gene manipulation was possible. The scenario of the lecture was that a meeting was being held at the main Genecorp facility, to which "key stakeholders" (the students) had been invited to discuss the costs and benefits of this technology. We, the "researchers", wanted to know whether or not to proceed with the development of this technology and in what way.

The tables below show the general outline of the final lecture structure, with some explanation added where necessary.

Part	Time [min]	Presenter
1. Introduction	5	Niklas
2. Theory: Cost Benefit Analysis	5	Niklas
3. Discussion: chemical plant next to preschool or prison?	10	Niklas

After introducing the company and the theory of cost benefit analysis, students were introduced to the following problem: a chemical plant has to be built in the town of Gattaca. However, only two locations were possible: either next to a preschool or to a prison. The students were asked what they found was the best place to put it and why, knowing that there were risks involved (e.g. explosion of the plant). Most people found it better to place the plant next to the prison, because the value of the preschool students to society was still to be determined (i.e.: they can still be of great value), whereas for the prisoners we already know that they cost money and do not represent a lot of value. Someone however mentioned that the education of these preschool students is also very expensive.

4. Gamble game	10	Jouke & Elias

Jouke and Elias each stood on a table, representing the choices A or B for four gambling scenarios (see slides). The students had approximately 30 seconds to think about each statement to choose and walked to either Jouke or Elias. For the students who chose an answer that involved gambling, a random number generator was used. If they had for example, a 50% chance of winning and a 50% of losing, the numbers 1-5 represented winning and the numbers 6-10 losing. The prize was candy, which made it a fun moment. Also, the sugar was needed to get the sleepy students going.

5. Theory: The human element	5	Jouke & Elias

After the game, Jouke explained how people often make decisions irrationally, which was illustrated in the gambling game. Elias gave some other examples of irrational behaviour and another question was asked: are there more words having R as a first letter or more having R as a third letter? Most in the class agreed that there are more words having R as a first letter, because it is easy to come up with those words. The answer however is that there are three times more words (in English) with R as a third letter.

6. Theory: Balancing risk & safety	10	Nelson
7. Discussion	45	Anna

First, Anna took five minutes to explain the structure of the discussion. There were three rounds. In the first round (10 min), the class split up in their week groups and discussed the following statement:

"Human gene manipulation is possible. How far should we go as society? And against what price?"

Each group represented a different stakeholder in the gene manipulation issue (see slides). Each group was moderated by one of us, and Caroline also moderated one group. We thought in advance about some discussion points that were relevant to our specific stakeholder, such that we could throw in one of those if the discussion slowed.

Before the second round, each moderator handed little papers with a number varying between 1 and 6 to each student in their group. Those same numbers were printed in A4 format and hung in different places around the classroom. In the second round, all students were asked to walk to the number that was on their little sheet. In this way new groups were formed where all stakeholders were represented. Then they had to discuss the following problem in 15 minutes:

"You have a limited budget: 20 coins. How many coins would you spend to eliminate each of the following diseases/problems?"

1. Low IQ

2. Criminal behaviour

3. Cancer

4. Social disorders

5. Depression and addictive behaviour

6. Neuro diseases (Alzheimers, Parkinsons…)

The groups were again moderated by the "researchers", and students were asked to respond from the perspective of the stakeholder they represented. After discussing they agreed on the distribution of coins for each factor disease using a form that was distributed, which can be found in the attachments.

In the third round, each group was asked to explain their outcomes in a few minutes and the results of the different groups were compared. It turned out that most groups wanted to spend a lot on especially cancer and neuro diseases, whereas the issue of a low IQ was granted a sum total of three coins.

8. Evaluation and feedback	5	-

Overall, we were happy with the way the presentation went and the feedback we received.

Notes and Attachments

The presentation went well since everyone was well-prepared. The other students were receptive and attentive to the two theory parts and actively participated in the interactions and discussions. We feel that we were able to convey important knowledge and have them apply it to an interesting topic in an understandable and reasoned way. Moreover, we had good team moral as everyone was working diligently and we didn't have to deal with freeloaders. We also started planning early, worked hard individually and met frequently.

What follows is the handouts which were printed, followed by a collection of notes made during meetings.

UnitedHealthcare

GENECORP
Custom Designed Babies

GATTACA, 7th October 2035

Dear client,

With this letter, we as your health insurer would like to draw your attention to our latest insurance program. As you might have noticed, a lot of progress has been made in the development of gene manipulation technology over the last few years. This technology, invented by biotechnological company GeneCorp, makes it possible to eliminate gene irregularities in people up to the age of 65 years. Over the past 6 months, final steps have been taken to introduce this new technology into society. And because we care about you, we decided to offer you a once in your lifetime opportunity to use this technology at a discounted rate!

How does it work?

It's easy! Just tick the boxes below that represent the diseases or problems that you would like to eliminate from your gene code. This means the risk you will suffer from this disease will be reduced to 0.1%. Prices are indications and can vary according to your age and medical history.

☐	IQ below 90	20 months of income
☐	Criminal behavior	12 months of income
☐	Cancer	28 months of income
☐	Social disorders	22 months of income
☐	Depression and addictive behavior	16 months of income
☐	Neuro diseases (Alzheimers, Parkinsons…)	24 months of income

When filled in, please send back this form in a closed envelope to the following address:

UnitedHealthcare headquarters

DNA-street 255

5836GM GATACCA

Kind regards,

United Healthcare

GENECORP
Custom Designed Babies

Disease/problem	number of coins
IQ below 90	
Criminal behaviour	
Cancer	
Social disorders	
Depression and addictive behaviour	
Neuro diseases (Alzheimers, Parkinsons…)	
	Total: 20

Hi all, welcome…etc

To start the lesson with, we want to introduce you to the content of today: Risk Analysis & Safety Engineering. To let you shortly touch the content of the subject, in the coming minutes we will show you several statements. We want you, all at the same time, to put the card in the air which, according to you, belongs to specific statements. Let it be clear, that the green card means: 'I'm not willing to take the risk; also 4risk aversive' and the red card means: 'I'm willing to take the risk; also risk seeking'. We made a distinction in colours to have a quick overview who of you is risk aversive or risk seeking.

Introductory statements:
Small papers with checkboxes and 1 price in the end, or 2 parts of the classroom that you have to walk to.
Price: candy
www.random.org
1a. 50% chance to win €1000, 50% chance to win nothing
1b. €450 for sure
Note: expected value of 1a is higher; rationally people should choose the first option (€500>€450)

2a. 50% chance to win €5000, 30% chance to win €2500, 20% chance to lose €3000
2b. €2500 for sure
Note: expected value of 1a is higher; rationally people should choose the first option (€2650>€2500)

3a. 70% chance to win €100, 30% chance to win nothing
3b. 90% chance to win €200, 10% chance to lose €200

4a. Losing €500 for sure
4b. 70% chance to win €500, 30% chance to lose €3000

(-St Petersburg paradox.
What would you pay:
5a. less than €10
5b. more than €10)

We can easily make more, if needed. But I think it's already clear after 4 statements. Short reflection: according to Daniel Kahneman's Prospect Theory (article mentioned on EdX), people are more willing to take risks when possible losses are involved, while people rather take money for sure, instead of possibly not winning money at all. Different/same as in the lecture?

Theory:
- The human factor

Case:
Self-driving vehicles?

-Gene-manipulation (in crops, but in the future also on humans --> creates a lot of possibilities, but also risks.)

-3D printing (do you want people to be able to print their own guns?)

-Artificial intelligence: Robots as factory workers, caretakers of children and elderly, surgeons, drivers (self-driving vehicles), etc. A huge risk of this innovation is that a lot of people are going to lose their

jobs in the future, when robots can do their jobs at a lower cost.

-The EPD (Elektronisch Patienten Dossier): If the medical history of a patient is shared with all his doctors/pharmacists/etc., the probability of a wrong medicine prescription for example becomes lower, but the risk of hacking these files becomes higher.

Planning:
Theory
- Intro 5 mins
- Theory: CBA 5 mins.
- Interaction moment: value of human life: 10 mins
                                    nuclear plant next to pre-school
 Name values from sectors
- gamble game
- human element
- balancing risk & safety
- interaction moment?

Case study
6 groups:
- Future parents
- Gene-manipulated child
- Not gene-manipulated child
- Researchers on gene-manipulation
- Doctors
- Government

-Discussion in group: 10 mins
-Discussion in between groups: 10 mins
-Explanation/presentation: 15 mins

Gattica movie fragments: 10 mins