UNIVERSITY OF COPENHAGEN
FACULTY OF SOCIAL SCIENCES

Dreaming Differently:

A Creative Approach for Communicating Digital Risks

Dissertation by
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Masters of Science - Security Risk Management

Title:	Dreaming Differently: A Creative Approach for Communicating Digital Risks
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Submitted:	November 2018
Department:	Department of Political Science, University of Copenhagen
Number of Keystrokes:	191,485
Number of Standard Pages:	79
Number of Total Pages:	85

Abstract

Using Ulrich Beck's risk society as a theoretical foundation, this thesis explores the meaning of digital risks as immaterial and highly uncertain risks: where the greater the risk becomes, the more invisible it may be. Given this nature, these risks are often filled with many unknowns and high variability, they may exist far into the future, and may be difficult to perceive or understand with current institutions and mindsets. Furthermore, in a 'digital' risk society, it is not merely the failure of such institutions that generates these digital risks, but also the success. In order to identify and analyse such invisible and ambiguous risks, this thesis asserts that they must be communicated early on. It argues that fictional storytelling- rooted in academic theories and concepts- can be used as a messenger. This method acknowledges and builds from their inherent uncertainties and makes digital risks experienceable, visible and understandable while allowing for various interpretations. This approach aims to facilitate open discussions about the different ways to progress into the future, and provides the opportunity for active transformations and decisions. To demonstrate this practically, I provide a case study analysis of a short fictional story that I authored, which is intended to generate discussions around the digital risks caused by using technology to respond to climate change. The message I constructed involves technology gaining power over human beings when it is used as a mediator for decision-making and as a mechanism for understanding the world. The case study centres on the process of using academic concepts and theories to create a message conveyed through fiction. Finally, I offer insight into the next steps necessary for digital risk communication: by engaging with a target audience and discovering how such a message is received.

Keywords: digital, risk, communication, storytelling, fiction, climate change, technology

Acknowledgements

This dissertation was partially completed thanks to funding from the Fridtjof Nansen Institute, the Nordic Council of Ministers, the ARCTOS Research Network, and the UArctic Network.

First, an immense thank you to Dr. Lau Blaxekjær for his invaluable guidance as my Thesis Supervisor at the University of Copenhagen, and to Dr. Helena Reinardy for her assistance, support, and research supervision at the University Centre in Svalbard during my coursework and fieldwork. A very special thanks to Dr. Leif Christian Jensen, Dr. Tor Håkon Inderberg, Dr. Svein Vigeland Rottem, and the others at the Fridtjof Nansen Institute for their mentorship and for selecting me for the incredible opportunity of researching alongside them.

I would like to recognise the institutions that allowed me to take additional education during my graduate studies; the University of Oslo, the University Centre in Svalbard, Nord University and the University of Tromsø. Thank you to the individuals who encouraged me and influenced my research, especially; Dr. Karen O'Brien, Dr. Asuncion St. Clair, Dr. Uffe Jakobsen, Dr. Ulrike Grote, Dr. Nina Witoszek, and Dr. Mareile Kaufmann: thank you all for your instruction and inspiration over the last two years. Finally, an acknowledgement to Amund R. Johnsen and Mark West at Bouvet Norway for their review, direction and support regarding the data science and analytical components of this dissertation.

Most importantly, it is with tremendous gratitude to my parents, brother, sister, and entire family that I dedicate this dissertation. Your uncompromising love and support across any distance has allowed me to make the most of this experience. I can never thank you enough.

Contents

Do you want to endure a slave's life
And keep serving an age that leads you by force?
No, you must create a new, stalwart age.
The universe is ceaselessly changed by us.
You must go a step further
Than using up all the energies of nature
Like the tide and the wind;
You must try to form a new nature.

Copernicus of the new age:
Set this galaxy free
From the oppressive law of gravity

Marx of the new age:
Reform this world that moves on blind impulse
And give it a splendid, beautiful system.

Darwin of the new age:
Board the Challenger of Oriental meditation
And reach the space beyond the galaxy.
From there, send us a purer, deeper, more accurate
Geology and a revised biology.

All that labor on the farm
Performed as if driven by an impulse:
Through a cool and transparent analysis
Elevate it, together with
Its dark blue shadow,
To the level of dance.

New poets:
Obtain new, transparent energy
From the clouds, from the light, from the storms
And suggest to man and the universe the shapes they are to take.

- excerpt from "To My Students" written Kenji Miyazawa (1926);
[translated by Makoto Ueda (1983)]

1. Introduction

> 'Aimless extension of knowledge, however, which is what I think you really mean by the term curiosity, is merely inefficiency. I am designed to avoid inefficiency.'
>
> - R. Daneel Olivaw (The Caves of Steel, written by Isaac Asimov: 1953)

Relevance

The Doomsday Clock is a symbolic clock representing humanity's proximity to destroying the world with 'dangerous technologies of our own making' (BAS, 2018). Maintained by the Bulletin of the Atomic Scientists, midnight represents total global destruction (ibid). In 1953, the fear of nuclear annihilation caused the Doomsday Clock to be set at two minutes to midnight. Not until 2018, with the risks and catastrophes of climate change on humanity's metaphorical doorstep, has it ever been so close- at two minutes to midnight- again (Bronson, 2018). Climate change, along with the effects of environmental degradation, extreme weather and potentials for flooding, drought, migration, and starvation, represents a significant type of threat that is special to a modern, industrial way of life: one of humanity's own making (Beck, 2009a; Beck, 2016).

In the past 100 years, there were many threats humanity experienced, such as economic crises, wars, and space travel. More recently, we are concerned over climate change, pandemics, and migration, which draw much of our attention today. What about beyond this? How can we gain insight into the longer-term future and discover the risks that await there? Knowing they are full of uncertainty, how can we openly discuss them, to determine what next steps to take to avoid catastrophe? As practitioners in the field of security risk management, it is important to remain proactive and to identify, analyse, communicate, and manage them, to prepare relevant institutions for the next phases of potential threats.

This thesis focuses on one aspect of this: while climate change is drawing humanity's gaze, the Fourth Industrial Revolution is growing in our periphery. This wave of digitalisation will have tremendous impact across the globe and across most aspects of human life (Schwab,

2016). Such a change will naturally have consequences for the field of security risk management, and in particular the practitioners and practices that govern it, including both the use of digital tools to manage risks, as well as the managing of new risks caused by digitalisation (Levy, 2015; Deloitte, 2018). This radical digital transformation of society will bring about new and insidious risks, which may not have clear consequence or form. These are digital risks; immaterial risks that are difficult to discern and communicate, and the more at-risk we become, the more invisible they may be. Their discovery always lies in the uncertain future, as they are by nature always 'becoming' but not yet present dangers (Beck, 2009b:292).

Examples of these uncertain risks, generated by this digital revolution, include the development of digital empires, artificially intelligent robotics, robotic augmentation of humans, new virtual territorial sovereignty and currencies, and even relationship building between robots and humans. In spite of their clear uncertainties, such digital risks are essential to become aware of and to have discussions about in order to actively prepare for and shape the future (Dunne and Raby, 2013). Using Ulrich Beck's risk society theory, extended to a digital risk society, this thesis aims to answer: *How can digital risks be communicated?* This question is becoming a critical one for security risk management, in order to prepare for all possible risks with the coming digital age, even those that may await in the long-term future: it is thus important as practitioners to discover and respond to all critical risks, not just the apparent ones.

The overall goals of this thesis are to examine the dynamic challenge of digital risk communication, to apply relevant theories and concepts to analyse a selected case for it, to critically reflect on this research process as a whole, and to present solutions for going forward.

1.1. Research Question and Outline

Digital risks are immaterial risks, and the greater the risk becomes, the more invisible it may become as well (Beck, 2014; Beck, 2016:98-101). Such risks are insidious, are not capable of being socially experienced, are inextricably bound to the future, and are thus infused with many unknowns and uncertainties (Beck, 2009b; Beck, 2014; Beck, 2016). Many approaches to risk function to reduce these uncertainties in order to make accurate decisions for managing them (Hillson, 2016). In order to approach digital risks and navigate a digital risk society, I pose one research question, divided into three sub-questions:

1. How can digital risks be communicated?
    a. What are digital risks?
    b. What is significant about the communication of digital risks?
    c. What possibilities are there to communicate digital risks?

I assert that the practice of using the same methods for material risks as digital and immaterial, may not be adequate, as it may reduce people's normative right to a discussion about their futures, which these risks may impact (Dunne and Raby, 2013). I call upon a challenging of dominating mindsets, and claim that despite the uncertainty of digital risks, discussions should still be encouraged and not delayed until the risks become immediate.

In order to define something as complex as digital risk, I begin with Chapter 2, where I outline my key terms, concepts and theories. Given the ambiguous nature of some of the terms, I use this space to argue for specific definitions and understandings, such as the social construction of risk. I then discuss the theories of Ulrich Beck, namely his theory on the risk society, and its extension to the digital; to the digital risk society, digital modernity and digital metamorphosis. Through these, I illustrate the emergence of digital risks from the Fourth Industrial Revolution, and provide examples of technologies and risks already on their way.

I then discuss the general process of identifying, analysing and communicating risks, and highlight the practices that involve envisioning possible futures. While digital risks are problematic insofar as they are tremendously uncertain, the solution many not be to simply reduce the uncertainty, as this may delay the risk process significantly. I argue that instead, risk practices need to communicate digital risks while they are still being identified and analysed, a decision which embraces the uncertainties inherent to digital risks. In doing this, there is a need to imbue them with meaning outside of science and a probability or consequence rating to be valid. I assert that storytelling is a useful tool because it 'concentrates the uncertainty of the future into narrations and thereby makes it experienceable' (Beck, 2009b:298). This process builds on the unknowns of digital risks, and makes their ambiguity their strength. By basing stories in something real- be it facts, concepts or theories- *academic* fiction can be formed, and digital risks can be made understandable and allow for discussions that engage the future.

In Chapter 3, I explain the methods and process of using a case study to demonstrate how academic fiction can be used to communicate digital risks. To do this, I construct my own short story as data, and in my analysis, I deconstruct the academic message that lies within it. In this chapter, I highlight in particular my decision to write my own story and the impact this has on the thesis, namely on its validity. I then include necessary explanations and results of the factors which I used to increase validity; namely, through fieldwork; the use of articles and reports; and the inspiration drawn from other academic storytellers. I then discuss my motivation, process and results (synopsis 3.3.3.) for writing *The Risk Manager*. I elaborate on my sources and process to construct validity, including the biases, ethics, and limitations for

my approach. I conclude this chapter with an overview of how I in turn use my story as data and assess the 'message' and 'messenger' components of communication for this case study.

In Chapter 4, I combine the theories and examples from Chapter 2, to conduct a case study analysis. The aim of my short story is to facilitate discussions along the scope of what digital risks might be generated by using advanced technology to make decisions about climate change. To do this, I necessarily introduce several new theories and concepts such as the Anthropocene and mitigation. I then present my short story, *The Risk Manager*, a science-/climate-fiction that depicts an extreme future where decisions are made by advanced technology, which has developed the capacity to understand Earth's complex and dynamic systems. It has thus been deployed to help humanity respond to climate change. The result is that humans have transferred control of shaping the future to artificially intelligent algorithms.

I then discuss the academic message behind the fiction. I assert that due to the inclusion of technology into the decision-making process as well as daily life, the traditional institutions of the political sphere which held power to construct definitions of what is and is not a risk, have now become indistinguishable from the techno-economic spheres of life (Sørensen and Christiansen, 2013:90-102). The result is that many climate change-related decisions are being made mediated by advanced technology. The consequence is that a shift occurs, where technology gains power over humanity as the mechanism through which human beings engage with, construct, and understand the world. This future further embodies that of a digital risk society (Lupton, 2016); one which through using technology to reduce climate risk, reflexively generates new, invisible, immaterial, digital risks (Beck, 2016). In using storytelling, I allow such risks to become experienceable, while still incorporating their natural uncertainty.

By using this case study, I demonstrate how fiction can allow insight into digital risks. I conclude Chapter 4 with a brief discussion on the next steps necessary for this study, namely the second half of the communication process (Lundgren and McMakin, 2013). This thesis revolves around using fiction as the messenger and the case study examines the academic message within it. But what about the recipients? Who are they and how is the message received? I assert that the next steps of this research are to engage with the target audiences and to assess how the points from the story are interpreted, what kind of digital risks are discovered, and what kinds of discussions are subsequently had. Despite their uncertain or speculative nature, digital risks are no less important to discuss and be aware of. They present special challenges to risk practices and the use of fiction can facilitate their communication, analysis and discussion in ways that may offer the means for actively shaping what the digital future ultimately becomes.

2. Theoretical Discussion

'Replicants are like any other machine- they're either a benefit or a hazard.
If they're a benefit, it's not my problem.'
- Rick Deckard (Blade Runner, directed by Ridley Scott: 1982)

Overview

My research question is: *How can digital risks be communicated?* I have broken this question down into three sub-questions, which are all answered in this chapter, in order: *What are digital risks? What is significant about the communication of digital risks? What possibilities are there to communicate digital risks?*

I begin with section 2.1. where I examine and deconstruct digital risks, including outlining my key concepts and theories. I argue for specific definitions of concepts such as risk and uncertainty, and assert that this thesis follows the understanding that risk, like knowledge and the future, is a social construction. I then discuss Ulrich Beck's theory on the risk society and the key notions within it such as modernity, second modernity, reflexivity, and global risks. I extend these concepts to discuss its applications and his later work; namely that of a digital risk society, a digital modernity and a digital metamorphosis. Throughout this process, I aim to clarify the meaning of digital risk and answer the first sub-question.

I continue in section 2.2. to answer the second and third sub-questions, by examining general practices and processes for identifying and analysing risks. I assert that the identification and analyses of digital risks can take a significant amount of time when seeking greater certainty. Rather than waiting for accuracy and reducing uncertainty, risk practices need to embrace and use the uncertainties inherent to digital risks to communicate them early on, even though they may still be in the identification or analysis phases. I argue that digital risks can be made apparent and allow for discussion through the use of storytelling; through apocalyptic discourse and myths, and in particular various genres of fiction. I conclude with arguing that academic-based fiction may can be a useful messenger of digital risks.

2.1. Digital Risk

I begin this section by acknowledging that risk is intertwined with the future and involves the anticipation of the events still to come. Different futures can be actively sought after to preserve one's values, and to do this, uncertainty must be calculated to gain greater clarity on how to act. To determine if something uncertain is a risk, the effect it has on one's values can be analysed through probability and impact. Alongside the future and knowledge, I assert that risk is a social construct, based on perception and value. It is inherently subjective and becomes a powerful concept in prioritising and preserving certain values over others. If something is framed as a risk, it elicits certain responses around possible causes and solutions (O'Brien, 2013).

The need to assess risk in society and use it for decision-making regarding the future becomes the cornerstone of Ulrich Beck's risk society. His theory revolves around the notion of modernity- a conceptual shift from industrial to risk societies. The future becomes something that can be influenced and risks can be actively controlled (Arnoldi, 2009). This creates reflexivity, in which society is faced with consequences of its own progress. As such, new risks are generated from actions taken to control risk. In a globalised world, these risks also become global, and a world risk society is born. These global risks, which are not bound temporally or spatially, mark the basis for *digital* risk. As technology develops with increasing speed and severity, it generates new risks that are immaterial and highly uncertain. They are an inversion of many other types of risks, in that the riskier they become, the more invisible they may be.

These risks are difficult to approach, especially given the framework of the risk society, where such risks are caused by the very technologies being used to discover and solve them: creating a *digital* risk society. With predictive technologies being used for decision-making, it becomes clear that technology is something much more complex than a simple tool for understanding. In a digital risk society, it is both the failure and success of institutions that create these risks, and they thus lie in the side effects of the process (Beck, 2000). Despite this, and despite increasing distrust in science and the modernising process (Arnoldi, 2009), knowledge of the future still remains something largely sought after by calculation (Burgess, 2016): in spite Beck's hope for a transformation away from this.

As new technologies are developed, new digital risks emerge. In this section, I also provide an overview of where we are headed; the Fourth Industrial Revolution, and the technological advancements and possibilities that may await there. I contrast this revolution with that of Beck's *digital* modernity, and the possibility of transformation by metamorphosis. I include various examples of digital risks, and conclude by highlighting the importance and possibility of dealing with this insidious, immaterial and unknown type of risk.

2.1.1. Risk and Uncertainty

'Risk is not a thing, but a calculation-even a way of thinking about- the future' (Burgess, 2016:12, italics removed from original). Sociologist Ulrich Beck states that 'risks are not "real," they are "becoming real" (Beck, 2009b:292). Risk involves the anticipation of the future, which in turn is conceived as an extension of the present (Beck, 2009b; Beck, 2010). This thesis defines the future openly, as 'all the events in time which are still to come' ('Future', 2018), and is a constructed notion (Douglas and Wildawsky, 1983). This means there are, in fact, many possible futures one can envision, the most crucial aspect of which is the understanding that the decisions and actions taken today create causal effects, changing or influencing what *the* future ultimately becomes (Bammer and Smithson, 2008; Beck, 2010; Wotony, 2016). In recognition of this, society organises itself around these anticipations of the future; including the anticipated possible negative outcomes, which become perceived as potential risks. In doing so, individuals and organisations may actively work toward futures that are representing the best outcomes for their given set of values (Burgess, 2016).

The definition and indeed debate around the definition of risk is largely centred on the different understandings of and the role of uncertainty in human life (Kessler, 2010). Uncertainty, as one of the most basic elements of an ephemeral human existence (Bammer and Smithson, 2008; Beck, 2009b; Wotony, 2016), lies within the constructs of knowledge; what is known, how well it is known, and what isn't (Beck, 2010). Certainty is defined here as what has been discovered and is trusted: what one knows that they know. Outside of this completed knowledge, lies a spectrum of uncertainty. Plainly put, uncertainty is a lack of certainty, or incomplete knowledge ('Uncertainty', 2018). What is known or unknown, or how well it might be known, are subjective interpretations (Bammer and Smithson, 2008) and thus both knowledge and uncertainty are constructed notions.

For this thesis, there are three categories of uncertainty: aleatory, epistemic, and black swans (Bammer and Smithson, 2008; Arnoldi, 2009; Makridakis and Taleb, 2009; Paté-Cornell, 2012; Hillson, 2016). Aleatory uncertainty, or 'known unknowns' (Hillson, 2016: 226), describes knowledge with an awareness of its limitations or variations. Epistemic uncertainty, or 'unknown knowns' represent a possibility for greater certainty, but where current methods or capacity is limited; so one isn't aware of the knowledge they might have or be able to gain if a situation were different (ibid). 'Black swans', as discussed by Nassim Nicholas Taleb (2010), represent an extreme of epistemic uncertainty; whereby one lacks fundamental knowledge, parameters and other information necessary for even basic comprehension (Makridakis and Taleb, 2009; Paté-Cornell, 2012). It can also be considered as

a deep uncertainty- where one doesn't even know that they do not know something (Bammer and Smithson, 2008:338-347; Beck, 2009a).

Given the social construction of knowledge, uncertainties are interpreted through perspective. Uncertainty may be viewed differently, such as a risk or an opportunity (Hillson, 2016). It can be viewed as a 'source of creativity' and a 'reason for permitting the unexpected' (Beck, 2009b:291). Scientific inquiry and innovation, for example, are some aspects of human life which often see opportunity in uncertainty. In other aspects, however, such as in political and military arenas, there may be a different perspective to uncertainty: one of risk. This is in large part because humans have developed a craving for certainty, 'rooted in the deep-seated desire for security, the material, technological and social protection necessary for survival, comfort and well-being' (Nowotny, 2016:1-2). In this sense, uncertainty creates spaces for insecurity, which invite the possibility of negative outcomes, such as loss or danger.

When seen as that which threatens human well-being, this desire for safety and security becomes a driver to remove uncertainties. To do this, a building up or compiling of knowledge is required, and I refer to this as calculation: a deliberate process used to make uncertainties less uncertain. Risk is thus a subset of uncertainty, and while not all uncertainties may be considered a risk, all risks are uncertain (Beck, 2009b; Hillson, 2016). In practice, there are many understandings and uses for the term risk that vary across disciplines. In acknowledging this, I use the standardised definition of risk as the negative 'effect of uncertainty on objectives or values' (ISO, 2009) and I argue for this calculation of determining that effect:

RISK = PROBABILITY x IMPACT

Risk is the result of probability and impact (APM, 2004; IRM, 2002). Probability is defined here as the degree or likelihood that something (referred to henceforth as object) will be exposed to harm or loss; Impact is them the consequence and severity of the event creating potential harm or loss towards the object (Greenberg, 2017).

Despite those who have argued that risk is objective due to its 'calculability' (Garland, 2003:49), I centre my understanding of risk around its 'objectifications' or the mechanisms by which risk is- or is attempted to be- calculated, and what those calculations are then used for (Arnoldi, 2009**)**. How these objectifications of risk are interpreted and utilised serve different purposes and interests, and are shaped by a variety of factors such as culture, perception and value (Douglas and Wildawsky, 1983; Bammer and Smithson, 2008; Arnoldi, 2009; Beck, 2009a; Kessler, 2010; Burgess, 2016; Hillson, 2016). Advancements in technology have made

the methods by which risk is calculated increasingly sophisticated, but how risk practitioners interpret and communicate that information remain subjective decisions. This follows the understanding that risks are thus not objectively given (Beck, 2009a:140); through calculation they can be understood and given meaning, but ultimately risks are constructed through one's perception.

In defining risk as the negative effect of uncertainty on objectives or values, the subjectivity of risk becomes clear because values are subjective. What constitutes a negative effect on one person's values may constitute a positive effect on someone else's. How risks are defined, produced, interpreted, reproduced, and prioritised, are all dependent on one's values (Arnoldi, 2009; Beck, 2009a; Beck, 2009b; Hillson, 2016). Beck highlights this by noting that '[r]isks are constantly defined, contested and interpreted in the public sphere, in political debates, in the mass media and so on. In these interpretations the "objective" potential risks *fuse* with values, so that values defining what is right cannot be separated from facts about what is dangerous' (Arnoldi, 2009:49 citing Beck, 2007, italics my own). While risks can be assigned meaning through calculations, they are not objective because they are imbued with value. These values- by which I mean cultural, political, economic and moral- directly impact what can be considered, or viewed, as a risk (Beck, 2009a; Hillson, 2016).

This brings me to my final point: perception. What is of value, to whom, with what priorities and who gets to decide (Beck, 2009a; Beck, 2009b; O'Brien, 2013)? These questions highlight the function of framing the object of risk; which objects can be at risk, from what, and what action should be taken to reduce the risk (Arnoldi, 2009). In other words, how risks are perceived frames how one sees both the problems and solutions around it (O'Brien, 2013), and thus impacts how one responds. In this sense, risk becomes a powerful concept in society because of its ability to elicit certain responses if interpreted in a specific way. Determining what constitutes a risk is important because it determines the values that are to be preserved or eliminated (Beck, 2009a).

2.1.2. Risk Society

Risk plays a large role in human social lives and has become a 'defining characteristic of our age' (Burgess, 2016:3). Simply put, 'present action *requires* knowledge of the future in order to govern the future' (Beck, 2009b:292, italics my own). This is asserted in particular by Ulrich Beck (1992) through his theory on the 'risk society'. His argument- which has been criticised, rejuvenated, applied, simplified, complicated, pronounced dead, and resuscitated, more times

that I can count- nevertheless remains in contemporary discussions today and is continually referenced as new and uncertain challenges emerge.

The fundamental piece of Beck's theory is that of modernity: moving from industrial to risk societies. This represents a conceptual shift in the way risks are created and the future perceived: from uncontrollable dangers into calculable and controllable risks. '[O]ur perception of the future has changed. Modernity […] meant no longer letting the gods dictate the terms of the future. It meant a conception of the future that was more open, a future in which humans could engage rationally and strategically' (Arnoldi, 2009:36-37). Originally, risks were thought of as latent and unintended side effects, 'bads' of the modernising process aimed at producing 'goods' (Van Loon, 2002:20-21). At its core, what determines a risk society is the notion that risks arise from this industrial process itself- the scientific and technological processes that were primarily intended to solve problems- not to create more (Beck, 1992; Van Loon, 2002; Arnoldi, 2009; Sørensen and Christiansen, 2013**)**. This process of demonstrates how society is increasingly faced with the unintended and latent consequences of its own progress (ibid).

What marks the 'second' modernity is the notion of reflexivity regarding risk; when risks become the result of the very processes and institutions which modernity uses to reduce them (Van Loon, 2002; Arnoldi, 2009; Sørensen and Christiansen, 2013). In a risk society, it is also the success of industrialisation and the modernising process that generates risks- not just the failure (Beck, 2000). Once a society is aware it is generating risks, it responds to anticipate and reduce those risks. These actions in turn create new risks, requiring further action. Given this cycle, it becomes clear that that the risk society represent 'our late modern world spinning out of control' (Garland, 2003: 49). This production of new risks created from actions to control risk causes a redistribution across space and time; in a globalising world, risks become globalised themselves. Instead of controlling risk and reducing it, risk often takes new, unintended forms. Global risks, which are not constrained temporally or spatially, represent risks which cross many of the traditional boundaries that humans make, such a country borders or generations. It thus becomes a world risk society when the risks produced by modernisation have effects across the globe: both in the present and in the future (Beck, 2009a; Beck, 2009b).

For this thesis, these concepts of global risks and the world risk society come into play with the rapid development of technology. In a risk society, risks can come from all parts of life; environmental, financial, health, etc. Technological risks encompass a wide variety of risk related to technology, and with its increased uses, are coming to infiltrate other areas of life as well. Examples of technological risk include risks that extend to emerging technologies, including physical, information and cyber. Some examples could be a disruption of a service

due to a cyber-attack, the theft of private data, or the explosion of malfunctioning or degraded hardware. These are examples of risks that are derived from the *failure* of technologies; but if performing correctly and optimally, such risks are greatly reduced (Hillson, 2016). With digital risks however, this is not necessarily the case.

In Beck's book (2016), *The Metamorphosis of the World*, he highlights a category of risk that is immaterial- that cannot or is not easily able to be socially perceived- called *digital* risk. In addition to being immaterial, these risks can be hugely catastrophic (Beck, 2000), and the greater the risks are, the more invisible it may become. With climate change, for example, the greater the risks, the more visible the changes and dangers often are; higher water temperatures present greater bleaching of corals and increased biodiversity loss. For health, the greater the risk of death, the more visible the symptoms and physical problems often are (including deterioration for age); if the human body and mind are working optimally and without interference, there is a reduced risk of death. Digital risks represent an inversion of this, where a person dies without physically being hurt or degrading in any way. Plainly put, digital risks as these immaterial, highly uncertain, unknown and invisible risks which are generated by the increase in digitalisation and development of advanced technologies. Rather than these risks being greatest when the dangers become more and more apparent- these types of risks may be greatest when they are 'completely invisible' (Beck, 2016:98).

2.1.3. Digital Risk Society

Such digital risks are inherently tricky to identify, analyse and communicate as they are often filled with high levels of uncertainty, may be imbedded far away spatially or temporally, and may be difficult to perceive and understand given the norms, frameworks and institutions available at the current time. In a risk society, knowledge of the future becomes essential and greater clarity is increasingly achieved through developing technologies (Van Loon, 2002). Thus, we begin to see the making of 'digital' risk societies (Lupton, 2016). In a digital risk society, for example, technology used to predict the future is not for merely gaining understanding.

Predictions are largely for the purpose of manipulation; 'in order to prevent' undesirable aspects of the futures predicted (Beck, 2010:258) and as such, 'prediction is power' (Siegal, 2015:3). Information like this is prescriptive; it ceases to be neutral because its generation and use revolves around certain interests. In this way, the seemingly innocent goal of understanding is intertwined with decision-making. This applies in many respects- from smaller scale predictions of security lines at the airport, to larger scale predictions of the chaotic,

interconnected weather systems of the planet. It is in this way that in a digital risk society, technology has moved well beyond being a simple tool for understanding and towards something much more complex and powerful.

For example, in early 2018, 'machine learning [was used] to accurately predict the outcome of a chaotic [weather] system over a much longer duration than had been thought possible. And the machine did that just by observing the system's dynamics, without any knowledge of the underlying equations' (Vutha, 2018). Such machine learning capabilities involve algorithms- rules a machine uses to reach a particular outcome- that are 'automatically developing new knowledge and capabilities by feeding on modern society's greatest and most potent *unnatural* resource: data" (Siegal, 2016:4, italics in original). Technology that uses large amounts of information to predict, such as predictive analytics, necessarily needs to use criteria, called parameters, in order to sift through tremendous amounts of data and achieve an output. As it sifts through the data, it searches for patterns and other signals so it can achieve goals or outcomes sought by the creators (Hastrup, 2013; Hulme, 2013; Siegal, 2016). As a general rule, a human programmer sets these goals for the algorithm and its results may require some level of human interpretation (Hastrup, 2013). While the algorithms themselves can represent biases (Knight, 2017b), human beings greatly influence various aspects of the input and output stages, making the information from these algorithms subjective (Byrnes, 2016).

An example of such a process causing digital risks are digital 'freedom' risks (Beck, 2014; Beck, 2016:98-101), which stem from the emerging 'digital empires' that have far reaching effects extending outside of traditional nation-state boundaries (ibid). These can be far more difficult to understand, as they are creating a new form of empire that is based on 'characteristics of modernity which we have not yet truly reflected' (Beck, 2016:100). This risk revolves around control, where behaviour is surveilled and manipulated through digital means; the use of data and prediction to persuade people (Siegal, 2016), where '[o]ur choices in the twenty-first century world *are set out for us* by algorithms' (Burgess, 2016:3, italics my own). 'Seen like this, the real catastrophe is when the catastrophe disappears and becomes invisible, because the control exercised becomes an increasingly perfect one' (Beck, 2016:99). The most alarming aspect is that such digital risks can be difficult to detect. This is in part due to the way technology can appear 'open' from the outside and to observers looking in, but be entirely 'closed' for subjects and actors inside (Beck, 2016:96). Digital risks are precisely these immaterial and invisible types of risks.

'Risks for Beck are real insofar as there truly are new technologies that have unintended side effects to an extent never seen before' (Arnoldi, 2009:49). In a risk society, it is the failure

of institutions to control these insidious risks but also the successes of institutions that causes them (Beck, 2000). It is not just about good and bad side effects, but also the invisible ones, the immaterial ones. Beck explain this well;

> First, there is the process of modernization, which is about progress. It is targeted at innovation and the production and distribution of *goods*. Second, there is the process of the production and the distribution of *bads*. Both processes unfold and push in opposite directions. Yet, they are interlocked. This interlinkage is not produced through the failure of the process of modernization or through crises but through its very success. The more successful it is, the more *bads* are produced. (Beck, 2015:78, italics my own)

Thus, *bads* are not only outright obstacles; they are products, 'manufactured side effects' of the system (Van Loon, 2002:23). Through a guise of producing *goods*, institutions which have proven incapable of dealing with the original *bads*, produce more, making them greater and even more powerful (Beck, 2015). With digital risks, the cause and effect, those responsible and those impacted, and even the very 'distinction between fiction and reality' all become blurred (Beck, 2016:102).

These new risks and uncertainties mean that 'doubt and uncertainty are replacing trust and belief in progress through science and technology' (Arnoldi, 2009:50). Science becomes 'one of the causes, the medium of definition and the source of the solution to risks' (Beck, 1992: 155). Beck believed that a risk society would move beyond 'a future that is made knowable by measurement' and a quantitative understanding of the world as the basis for rational decision-making (Beck, 2009b:296). Yet instead we see the desire for knowledge and accurate predictions growing with advancement in technology, with 'no signs of interest in risk abating as we continue to try and exert control over the future through calculation' (Burgess, 2016:4).

2.1.4. Digital Modernity and Metamorphosis

As new technologies continually emerge, digital risks become of increasing concern. The examples of machine learning, predictive analytics, and the possibility of digital empires are just some of the possibilities generated by the Fourth Industrial Revolution. 'We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before" (Schwab, 2016). 'Industry 4.0' is this technological revolution (Ebadi, 2018), built on recent advances within big data technologies and storage solutions which are indeed moving science-fiction into reality (Minevich, 2017).

This shift is expected to change social life most in terms of labour, manufacturing, and service, especially with developments in automation and artificial intelligence (AI). AI is the blanket term regarding 'all efforts to enable computers to exhibit human-like intelligence' (West, 2018), which encompasses both machine and deep learning processes. It is becoming more and more integrated into business, and '[a]lready, AI can be found in boardrooms around the world, helping to inform key decisions' (van Rijmenam, 2018). Industry 4.0 represents a massive shift towards the inclusion of AI across various countries and infrastructures. Companies are already using AI technologies 'better capture, analyze and act on the intelligence gathered across its electrical grid' (Smith, 2017).

In particular, AI is harrowed as a saviour, which Mike Schroepfer, the chief technology officer at Facebook, says has the 'power' to 'solve problems that scale to the whole planet' (Knight, 2016). Such optimism resounds throughout the industry. The executive chairman of Alphabet, Eric Schmidt, also believes that AI can be used to solve the world's major challenges (ibid). Demis Hassabis, CEO of DeepMind, Google's machine learning division, believes that these technologies can be applied to 'all sorts of things to make the world a better place' (ibid). Yet this sentiment touches the very foundation of reflexive risks that mark the digital risk society. As Microsoft president Brad Smith commented;

> When we think about the environmental issues we face today, science tells us that many are the product of previous Industrial Revolutions. As we enter the world's Fourth Industrial Revolution, a technology-fueled transformation, we must not only move technology forward, but also use this era's technology to clean up the past and create a better future. (Smith, 2017)

Organisations of every kind and across the globe are enthusiastic about the new possibilities and efficiencies that this change may bring. Businesses, governments, and consumers across the globe are rushing to be at the forefront and reap the benefits from such a shift (Minevich, 2017; Lehmacher, 2018). In fact, many governments around the world have developed strategies and regulations for the uses and developments of new technologies like AI (Ebadi, 2018). Questions like '[c]an politicians take the lead of artificial intelligence?' are becoming increasingly essential and found as the topics of political conferences (Aftenposten, 2018).

As an example, the European Parliament (2017) produced a report to the Commission on Civil Law Rules on Robotics that '[c]alls on the Commission and the Member States to foster research programmes, to stimulate research into the possible long-term risks and opportunities of AI and robotics technologies and to encourage the initiation of a structured public dialogue on the consequences of developing those technologies as soon as possible' (EP,

2017:9). The report pushes the opportunities of innovation and the potentially extreme economic benefits of fostering it, while still noting and highlighting the many potential risks. It argues because of the tremendous uncertainty, '[r]obotics research activities should be conducted in accordance with the precautionary principle, anticipating potential safety impacts of outcomes and taking due precautions, proportional to the level of protection, while encouraging progress for the benefit of society and the environment' (ibid:22). This approach is used to make decisions when there is significant lack of certainty or consensus. Decisions are thus made based on confidence, but through possibility. It 'authorizes decision in anticipation of the uncertain future' (Amoore, 2013:9), and its application for digital risks will be discussed further in the next section.

Such a radical shift in social and industrial life and the connecting of previously separate public and private actors mark what Beck refers to as a 'digital modernity' (Beck, 2016:102). He argues that this change however, can be fundamentally different from a digital revolution like what Schwab described, in that it offers possibility for a 'metamorphosis' or an active transformation (Beck, 2015; Beck, 2016). To Beck, this type of revolution involves technology causing social changes, rather than social changes being what actively shapes the technology. It is about 'the metamorphosis of modes of existence: social closeness is being decoupled from geographical closeness; the distinction between fiction and reality is becoming blurred; and modes of (un)controllability by the nation-state, together with the contradiction of being uncontrollable and controllable at the same time, are beginning to appear' (Beck, 2016:102). Here the very foundations of society and progress are being questioned, which marks an 'emancipatory side effect of global risk' or 'emancipatory catastrophism' (Beck, 2015; Beck, 2016:101; Mythen and Walklate, 2016). This opens society up to undergo complete new and fundamental change- a metamorphosis into the new age- a *digital* metamorphosis (ibid).

In terms of digital risk, this is important, because these technologies are what present the highly uncertain and unknown elements of these risks.

> It is difficult for technologists, researchers, policymakers and users to develop measures to mitigate the risks associated with these technologies because there is a lack of education and awareness on the ethical and social implications of AI. Furthermore, since AI is seen to have global impacts, regardless of the specific geographic location that it is being employed in, it is important for technologists to be aware of the varying political, social, cultural and economic systems that may incentivize or allow individuals to use AI to suppress, oppress or control others. (Ebadi, 2018)

The rapid development of technology also causes digital risks that may only materialise very far into the future, such as the challenges of 'controlling AI should it become vastly more powerful and independent- something that is very far from possible today' (Knight, 2016). Technologies that offer this and other possibilities, like deep reinforcement learning and artificial general intelligence, are just in their infancy of innovation, with five, ten or even more years estimated until they are in their prime (Panetta, 2017). There is also the matter of technologies working with decision-making, which create ambiguity, 'making it difficult to discern who is ultimately responsible for the consequences or impacts that certain technologies have. In fact, by relegating decision-making to these technologies, individuals may be less apt to critically think about the consequences of the decisions being made' (Ebadi, 2018).

Other issues may arise as well, as digital risks are born from the immaterial and invisible side effects of Industry 4.0. In addition to digital empires, examples could be effects on human connection and empathy, relationships between humans and technology, human physical and cognitive augmentation, control and influence on decision-making, the processes of learning and understanding, the impact on labour and education, and the technological mediation of physical and virtual worlds: all of which suddenly become enormous unknowns. Such examples of digital risk are fraught with very high levels of uncertainty and are stretched boundlessly across the time and space. While visible risks have typically taken priority (Adam, 1998), I assert that the invisible and immaterial digital risks are no less important to consider, as their neglect could be catastrophic (Beck, 2016). The fact that they are so difficult to understand and perceive becomes a challenge, but one that this thesis asserts, it is not insurmountable.

2.2. Engaging with Risk

Above I have answered my first sub-question, where I defined and provided examples for digital risks as the immaterial, uncertain, and unknown risks caused by the increase in digitalisation and development of advanced technologies. In the second half of this theory chapter, I will answer the next two sub-questions: *What is significant about the communication of digital risks? What possibilities are there to communicate digital risks?*

I begin by stating that this thesis recognises all those who act at various levels with the perspective of risk as risk practitioners, and that due to limitations, I focus not on who is acting, but what actions can be taken. I define these actions which work to direct or control a risk situation as risk management, and highlight three steps in this process: identification, analysis and communication. I argue that due to their high levels of uncertainty or invisibility, digital risks are significant because they need to be communicated while they may still be in the

identification or analysis stages, rather than after. I assert that to approach digital risk may require a special method, and discuss some possibilities in current risk practices.

At their core however, many risk practices function by reducing the complexities of the world, simplifying it to become actionable. This process, called abstraction, has consequences, where one may lose value, connection, and interdependency. I assert that it is problematic because it simplifies and generalises when there may still be important factors only found in the details. It is in this way that I argue digital risks need to be approach from the inside-out. I then challenging the modernity mindset; one that devalues the humanities and art for a more mechanised and technological path. Beck believed that a digital metamorphosis meant social change could be active, rather than passive. Within this, I assert that an important possibility is found through the idea of embracing uncertainty, rather than reducing it. Even in a risk society, this is possible as humans are specifically taught how to feel uncertain and about what. In this way, one can build a mindset of personal robustness to embrace and actively shape the future.

Building from this, I discuss the possibilities brought by storytelling, a form of narrative that offers the opportunity to envision and discuss digital risks despite their uncertainty. Stories offer the opportunity for risk to be seen not as a problem, but as a component of imagination. This can help discover challenges that lie outside the categories of true and false. I discuss the various types of stories that do this; including, apocalyptic discourse; utopian/dystopian writing; and science, historical and climate change fictions. These types of stories can draw from facts, theories, and concepts that are relevant in academia, and I thus argue that academic-based fiction can be one possibility for communicating digital risk. Through this, digital risks can use their uncertain nature as their strength, and can offer means to facilitate discussions on what direction societies are headed and what the possibilities there are for active transformation.

2.2.1. Risk Practices

In this thesis, I refer to those with authority and decision-making responsibility at all levels (including over oneself) in the perspective of risk as *risk practitioners*. This is purposefully vague, as it does not delegate 'power relationships of defining risks' (Beck, 2009b:298), the effect of which is something that will be examined later on in Chapter 4. While not everyone can or does actively shape their own paths through the consideration of risk, I argue that it is not solely risk analysts and managers who are capable of delineating risk at different levels of society, and indeed it becomes everyone's normative responsibility to consider the digital risks that await in the future and discuss them (Dunne and Raby, 2013). Because of the limitations

on space, this thesis centres only on the actions taken regarding risk and not on those who are acting.

These actions regarding different practices of risk at various levels are what I refer to very generally as risk management, which is defined here as the activities to direct or control a setting or situation with regard to risk (ISO, 2018a). There are three general steps or practices in this process which I will highlight: identification, analysis, and communication. First, one must identify the possible risks to a given objective or value, and this includes the process of finding recognising and describing the risks. Describing risks at this stage usually requires general knowledge of the sources, events, causes and/or consequences involved (ISO, 2009). This must be done prior to the analysis- which is the next step- the evaluation of the level of risk (discussed previously in 2.1.1. as the result of probability and impact). The analysis is often done so that decisions can be made on how to treat and respond to the risk. Risk practitioners then communicate the results of the evaluation and share information about the determined risks with other interested parties (ISO, 2018b).

For digital risk, the process of identifying and analysing risk can take long periods of time- in both quantitative and qualitative methods. Given that risk revolves around anticipation and prediction, this can include a variety of actions: from forecasting using past data for extrapolation, to surveying experts for opinions, to imagining possible futures through scenario planning (see Armstrong, 2001; Postma and Liebl, 2005; Makridakis and Taleb, 2009; Chermack, 2011).

> The critical question is, how can we plan, formulate strategies, invest our savings, manage our health, and generally make future oriented decisions, accepting that there are no crystal balls? This is a big challenge that must be faced head on to avoid unpleasant surprises and the catastrophic consequences that come from the illusion that accurate forecasting is possible, and that future uncertainty can be correctly assessed and effectively controlled. (Makridakis and Taleb, 2009:840)

As described here, there is a problem in that genuinely accurate prediction is simply not possible; the future is not a replication of the past or present (ibid:841; Beck, 2000) and so to abductively generate educated speculations cannot create certainty, only confidence. In terms of digital risk, waiting for greater confidence before communication can take an extensive amount of time.

An alternative risk approach (among many) that does not function based on certainty is the precautionary principle, discussed previously through the European Parliament (EP) report as one of the current approaches to dealing with technological and even digital risks (EP, 2017).

The precautionary principle revolves around the idea that if an action might cause irreversible harm, the burden of proof lies on generating scientific evidence to the contrary (Hulme, 2009). Here uncertainty is accepted and actions and decisions are made even with the lack of scientific certainty, consensus or confidence; '[i]t seeks not to forestall the future via calculation but to incorporate the very unknowability and profound uncertainty of the future into imminent decision' (Amoore, 2013:9). As François Ewald (2002) writes 'decisions are made not in a context of certainty, nor even of available knowledge, but of doubt, premonition, foreboding, challenge, mistrust, fear, and anxiety' (Ewald, 2002:296).

One criticism lies in the previous discussion of the subjectivity of value in regards to risk. In the EP report, innovation and economic values appear to be the priority- issues of ethics come after-the-fact, rather than being what actively shapes the technology. For example, the EP report asserts that 'it is vitally important for the legislature to consider its legal and ethical implications and effects, without stifling innovation' (EP, 2017:3). This also risks committing a teleological fallacy, making the 'error of thinking you know exactly where you are going and assuming that you know *today* what your preferences will be *tomorrow*' (Taleb, 2012:170, italics in original). As discussed, decision-making around risk is powerful and prioritising certain values over others has consequences.

For example, 'developing robotics may lead to a high concentration of wealth and influence in the hands of a minority' (EP, 2017:4). Seen here, one problem is that this approach may not generate equitable transformation, and instead perpetuate the values and beliefs which support the institutions and systems causing the problems: it could protect and preserve the very values that are in need of change (O'Brien, 2013). This approach to risk can function as a justification to engage in further or new activities that perpetuate the modernity cycle of finding and creating solutions to the problems it causes. For digital risk, 'risk profiling, algorithmic modelling, information integration, and data analysis become the authoritative knowledges of choice' (Amoore, 2013:9): processes where advanced technology is increasingly used (Lupton, 2016).

What is essential about any approach to digital risk is that discussions remain *open*. Values and ideas about the future must not be forced down, but rather laid out. One aspect of the precautionary principle and of other risk practices that provides opportunity is scenario planning. This is an analysis that is 'commissioned with the stated goal of aiding decision-makers in envisioning, understanding, and planning for the future' (Pulver and VanDeever, 2009:1). It is not aimed at clear predictions or forecasts but the creation of alternative possibilities relating to the future (Postma and Liebl, 2005). They function to 'provide plausible

narratives on how the future might unfold based on demographic, social, economic and technological developments' (Mehnert, 2016:5). These are anticipations- 'narrative storylines'- that 'explore possible future realities in the attempt to serve as a means of reflection about current human behavior' (ibid:18). As discussed previously, because these anticipations engage the future through decision-making in the present, they are imbued with power, and are inevitably scenarios of risk (ibid:19). In terms of digital risks, because of their inherent immateriality, there is a problem with a lack of *experienceability* (Beck, 2009b:298). The 'only way' of perceiving these immaterial risks then is through various forms of discourse, narratives, models and other visualizations (Mehnert, 2016:7) which call the risks into being (Beck, 2000; Van Loon, 2002:29).

Simply removing the immaterial from digital risks may not be enough however. Innovation and change come quickly, often before we can identify, analyse and communicate even just the possibility of more immediate risk. The speed that technology is advancing with is problematic, and as Beck's claims, 'the pace of development outstrips the cultural imagination of society' (Beck, 2009b:297). A digital risk society barely has the time to contemplate or respond to the current uncertainties and risks, let alone anticipate the ones humanity will face in the longer-term future. This is precisely the type of issue that preceded the 2001 terrorist attacks in the United States, and why the inability to 'foresee and prevent' these attacks was deemed a 'failure of the imagination' (De Goede, 2008:155 citing Salter, 2008). It has also been categorised as a problem for climate change response (Milkoreit, 2017:1). Yet digital risks cannot necessary be approached by a process that aims to simply improve predictions; a need from which they are in fact created. They are by nature highly uncertain and increasingly invisible, and instead, it may be necessary to actively encourage new ideas and viewpoints; to engage in exploratory research or dialectical inquiry which challenges pre-established ideas, frames and viewpoints from the very start of trying to understand the risks (Janis, 1972; Goodwin and Wright, 2009).

To answer my second sub-question, what is significant about digital risks is that it is necessary to communicate them before they are fully analysed and evaluated: even perhaps before they are fully understood or identified. This works against the idea of seeking 'certainty and security through knowledge of the future in the face of uncertainty as a basic condition of human knowledge' (Beck, 2009b:292). Many risk practices simplify, group together and abstract in order to gain better clarity. Given their unclear nature, this means digital risks may remain in the identification and analysis stages for long periods of tim, waiting for greater certainty before being communicated. In other words, the immaterial nature of these risks

causes delay, until the immaterial becomes acceptably material for action. This delay is potentially problematic; since the greater these risks become, the more invisible they become as well. By waiting for greater certainty in the identification and analysis phases, the less material the risks may end up being. To correct this, I thus advocate for the communicating of these risks while they are still in the identification and analysis stages, which means acknowledging and embrace their uncertainty and inaccuracy.

2.2.2. Changing the Script

Digital risk may not just a problem of the imagination. In his book, *the Denial of Nature*, philosopher Arne Vetlesen (2015) asserted that a problem lies in the active abstraction of the world; the 'fragmentation and isolation, splitting and reduction; it is anti-holistic, disruptive of and destructive to the dynamics of connection, relatedness, and interdependency- of belongingness to a particular place- intrinsic to all life in nature' (Vetlesen, 2015:157). The problem is this process is the fragmenting of the future so that it appears volatile and fragile (Wotony, 2016). With this, complex systems become understood only as the sum of their parts, and subsequently ignore or lose the added value from the connections between those parts.

'The problem with an approach, which extracts the general from the particular and then sets the particular aside as detail, illustration, background, or qualification, is that 'it leaves us helpless in the face of the very difference we need to explore' (Flyvbjerg, 2001:133 citing Geertz, 1995). Through simplification or generalisation, values are lost, and may not be regained once the parts are added together to look once more upon the whole. At their core, risk practices are a product of Beck's risk society, the need to reduce risk, whereby one uses a 'simplified model to understand the world, one that fragments and isolates different components […]. [T]he isolated and fragmented nature of [risk] management and practical technologies created within this model of reality allow uncontrolled interactions inbetween. This results in unforeseen and catastrophic consequences' (Pelling, 2011:88).

Abstraction grants understanding and insight into one small piece of a whole, similar to writing a summary of a novel. While the important aspects may be included (a subjective statement in itself), a tremendous amount of detail is left out as less valuable. A seemingly harmless and natural process, such simplification removes details and it divides the whole- thus rendering the connections invisible (Pelling, 2011; Vetlesen, 2015). All this is done in effort to reduce uncertainty, and yet, '[u]ncertainty is pervasive, written into the script of life' (Wotony, 2016:1). It is in this sense that this thesis makes effort to, as sociologist Karen O'Brien (2013) puts it, 'change the script'. The idea that there are 'individual and collective values, beliefs, and

worldviews that support the behaviors, institutions, and systems that create and perpetuate the problems to which we have to adapt' (ibid:307) is the mark of the risk society, and it is thus important to work against the very mechanisms responsible for creating digital risk when approaching it. In this way, it is not decision-making regarding risk from the top-down that is so essential, but from the 'inside-out' (O'Brien, 2013).

The immateriality, high levels of uncertainty, and invisibility are what constitute digital risk, and thus there may be a need for a non-traditional approach. The digital risk society's cycle of using technology to identify and create solutions to the very risks it produces is a key problem for this. The illusions of control, the goal of certainty, and the failure of imagination discussed above all may come to hinder our ability to deal with these types of risks. 'Modernity is valorized by "the" new but in a world that has lost the unity of perspective, "the" loses its special particular-universalist character. Speed is so intense that the very possibility of sustained newness is vanishing rapidly' (Van Loon, 2002:151). In following from Beck's metamorphosis, I assert that the mindset of progress and technological growth is not the only way forward into the future. It is the mindset which I challenge; one that values science, technology, engineering, and math over humanities, philosophy and art; that values facts and standardisation over exploration, experience and imagination (Thompson, 2018; Lueddeke, 2019).

This is not to say modernity and digitalisation should be avoided and we should go back to the way people lived before the industrial age. Beck elegantly said, '[i]f you see an opposition between modernity and nature, then you see the planet too fragile to support the hopes and dreams for a better world' (Beck, 2010:263). Rather than the technological path of Industry 4.0- that of a revolution that we must blindly follow and be shaped by- there is opportunity to tread purposefully through reflection and through metamorphosis. Beck described this as 'people and institutions that get involved in the *change of certainties* and how they get through it' (Beck, 2015:78, italics my own). Here there is opportunity to challenge the 'illusion' of control and the need for certainty (Makridakis and Taleb, 2009), and as such, I argue that a different mindset may be necessary for dealing with digital risk: one of fully embracing the unknown. Yet in a risk society, one so concerned over certainty and where risk and uncertainty aversion run rampant, is this change even possible?

Risk and loss aversion have been topics of study since 'ancient times' (Taleb, 2012:155). In *Why We Disagree About Climate Change,* Mike Hulme (2009) discusses some of the psychology around risk aversion, and finds an interesting distinction within human reasoning; namely, the *affective* and *analytic* reasoning systems. Affective reasoning is the ability to evaluate risks almost instinctually: it is intuitive, and automatic. The analytical

processing system is slower and uses assimilation, reflection, judgement and deliberation. According to Hulme, '[t]he rules of such a process and the appropriateness of use in given situations may have to be *taught explicitly,* for example to the young, naive or inexperienced' (Hulme, 2009:200, italics my own). This implies that people can be taught what to feel uncertain *about*, and *how* that uncertainty should make them feel. Despite the apparent cognitive or biological nature, there are also philosophical and religious implications of this, which may also provide insight into the various ways in which people accept uncertainty, or demonstrate 'faith' rather than a need for certainty. I thus argue that the modern mindset of a need for certainty is one that is taught socially, and so presumably, can be taught differently.

Taleb (2012) offers additional insight in a criticism of the modern obsession of what he calls 'predicting, predictioning, and predictionizing' (Taleb, 2012:139). To instead gain a 'nonpredictive view' of the world, he specifically argues for developing *antifragility* (ibid:141-167). Through a process of 'robustification' (ibid), he encourages that one psychologically wrestles back the control over accepting the randomness of life. This is in effort to get to a place where one feels they always have more to gain than they to lose (Klein, 2014:28), where the natural volatility of life is no longer so negative (Taleb, 2012:155-156). Given the insidious, immaterial, and even invisible nature of digital risks, an approach positive towards change, with a mindset of embracing uncertainty and of personal robustness may be favourable to one of prediction and certainty (Oatley, 2011). In terms of Beck's metamorphosis, such a mindset may provide risk practitioners with different skills to use for approaching the future. To answer my third sub-question, and determine the possibilities for communicating digital risks, I argue for one overarching method; one of the oldest methods humans use for making sense of the past, present *and* future: storytelling (Gottschall, 2013).

2.2.3. Narrative and Storytelling

Narratives can refer to any text or discourse, but in this thesis, are understood as those with a specific focus around the stories told by people (Creswell, 2007:54 citing Polkinghorne, 1995 and Chase, 2005). 'Stories are used to communicate with, influence, and engage audiences; they serve as artefacts to be investigated in terms of content, actors, relationships, power, and structure; they can be used to gather information, provide insight, and reframe evidence in ways that more science-ordered formats miss' (Moezzi, et al., 2017:1). I argue that storytelling is one possibility for communicating digital risks, while still incorporating and accepting the uncertainties of the future. Narrative is also an academic practice in social science, which at its most rudimentary, involves stories that people tell about their experiences (Landman, 2012). It

also provides the possibility to 'anticipate situations even before we encounter them' and provide insight into the future in unique ways (Flyvbjerg, 2001:137 citing Mattingly, 1991). Humans are 'story-telling' beings and stories can involve perspectives on the ways in which individuals experience life, and through which larger understandings about ourselves and the world can often be drawn (Gottschall, 2013).

With digital risks, storytelling becomes useful through Ulrich Beck's concept of experienceability, or how through literature such risks that are not capable of social experience can be socially understood (Beck, 2009b). It is necessary to some degree that risks become 'perspectivized' and stories, myths and literature are one way to do this (ibid:299). In using a story, one retains the uncertainty and ambiguity inherent to digital risks, while still aiming to making them socially experienceable. 'Without making the threat *artificially* visible, there is no way to get us to move into action' (Latour, 2017:218, italics in original). However, in making the immaterial, material; it can be argued that a narrative approach functions to reduce the future (Taleb, 2010:63; Oatley, 2011). The concern lies in the ability of a story to further simplify the world- to distort one's perceptions of it- engaging in further abstraction (Taleb, 2010:63-70).

> A novel, a story, a myth or a tale, all have the same function: they spare us from the complexity of the world and shield us from its randomness […]. The more random the information is, the greater the dimensionality, and thus the more difficult to summarize. The more you summarize, the more order you put in, the less randomness. Hence the same condition that makes us simplify pushes us to think that the world is less random than it actually is. (ibid:69)

In the case of digital risk, storytelling takes the randomness out of the future- and the very act of trying to translate immaterial into material invokes touristification- the 'systematic removal of uncertainty and randomness from things' (Taleb, 2014: 62-63).

The goal thus cannot be to simply make the immaterial, material. It is not just to communicate the risk: there needs to be a sharing and creation of collective perceptions (Beck, 2009b). Through a story, risks are created and experienced, and this means there are dynamics of power involved (ibid). While they remain open to interpretation, stories will still be written from certain viewpoints will still contain an unbiased message, especially if written academically. It is important to take into consideration who creates and controls what narratives and how they are used to influence action (Hulme, 2009; Beck, 2009b). This is especially true in terms of scientific communication, in which a narrative can be driven in certain directions to fulfil certain interests (Hulme, 2009:216 citing Trumbo and Shanahan, 2000). These means that like the precautionary principle, stories can be used to prevent the transformation of values that

caused digital risks. However, this thesis builds on the idea that there are many possibilities with: that stories can be used to achieve a 'different way of knowing' than that of generalisation and scientific reduction (Landman, 2012:33). Stories can be used for tremendous good: '[o]nly a diamond can cut a diamond; we can use our ability to convince with a story that conveys the right message- [indeed] what storytellers seem to do' (Taleb, 2010:84).

Stories are subjective representatives of the world: imbued with biases, opinions, values and world-views. But unlike attempts at objective representations, stories make their subjectivity their strength, the value of stories lies in their interpretations. Yet this has been criticised because it becomes an 'inaccurate' way to communicate risk (Cho and Friley, 2015:1). However, the goal of using a story to communicate risk isn't to gain accuracy, but to encourage discussion, to encourage the creation of shared and collective perspectives (Beck, 2009b). Indeed, if digital risks could be reduced so easily they would not need an alternative approach to be communicated.

In this way, storytelling can build from one particular risk practice: scenario planning. Unfortunately, it is often considered more art than science and as such 'has received little academic attention' or research (Chermack, 2011:29). Scenarios offer the opportunity to transfer knowledge in unique cognitive ways (ibid: 57), and indeed, storytelling does this as well. On a broader scale, stories may be able to grant insight to risks that would otherwise prove too uncertain or unreliable to be taken seriously (Mehnert, 2016:223). They can encourage us to consider extreme challenges that we may face, what kinds of solutions might be available, and they consequences action might have (Greenberg, 2017:261). In the case of digital risk, it also functions by involving qualitative (primarily descriptive or non-numeric) studies and research with disciplines and processes such as computer science, programming, information technology and security, cyber security, as well as data science and artificial intelligence (including machine and deep learning); areas where social sciences have largely been 'absent.' (Al-Amoudi and Morgan, 2019:1).

Storytelling regarding risk builds on the idea that risk might need to be translated from a scientific or technological 'problem to be solved' to that of an 'idea of the imagination' (Hulme, 2009:340; Mehnert, 2016:4). Hulme and others have applied this logic to climate change, whereby 'perhaps we can see what climate change can do for us rather than what we seek to do, despairingly for (or to) climate' (Hulme, 2009:341). In recalling Beck's hope for a metamorphosis rather than a revolution, I assert this same mentality can be applied to digital risk. As such, stories can help us to discover fundamental aspects within our assumptions about scientific reality (Thompson and Rayner, 2007). Indeed, a creative approach that transcends the

scientific categories of 'true and false' is precisely what I argue is necessary for digital risks, whose nature lies in the future, the uncertain, and the unknown (Hulme, 2009:341).

Stories can be communicated in a variety of ways. This thesis focuses on literature, and specific types of written stories and genres, described below. However, there are many alternative approaches that can be considered storytelling, such as poetry, operas, music, visual art, film, graphic novels and even video games (Gell, 1998; Bammer and Smithson, 2008; Dunne and Raby, 2013; Mehnert, 2016). Thematically, this thesis uses the four 'myths' or stories that Hulme describes, which are rooted in justice, nostalgia, pride and fear, and capture some of 'our most enduring psychological instincts as human beings' (Hulme, 2009:342). These, among many others, reflect the many ways stories can work to both portray and evoke fundamental emotions and aspects that are a trademark of humanity.

As is perhaps fitting in a risk society, for this thesis, I focus on the pride and fear myths in particular- or utopian and apocalyptic- myths that are in fact intertwined (ibid:348). The reason I highlight these two is that, like risk, interpretation largely comes down to perception. While a story may represent a utopia for one group, it may function as an apocalypse/dystopia for another (Dunne and Raby, 2013). According to Hulme, stories of pride come down to idea of control and of the human 'desire to dominate' (Hulme, 2009:348). Stories of fear, often signify the end of something, one of humanity's great fears: change (Kiehl, 2016: 25). However, too much fear can also be paralyzing (Mehnert, 2016: 127-146). In Naomi Klein's novel (2014), *This Changes Everything*, she highlights that too much fear can immobilise or cause denial, rather than be a call to action or reflection. We 'fear that letting in the full reality of this crisis will change everything […]. Fear makes us run, it makes us leap, it can make us act superhuman. But we need somewhere to run *to*. Without that, the fear is only paralyzing." (Klein, 2014:4-28, italics in original).

Yet this is where storytelling can be powerful, because it can offer means for a collective vision of where to actively progress towards. Stories may cause us to ask fundamental questions about who we are or how we live, and as Beck believed, in times of crises this is precisely what is needed, a renewed opportunity for growth and fundamental change. This is an 'opportunity' for change, for metamorphosis: the emancipatory side of the catastrophe (Folke, et al., 2010 Beck, 2015; Beck, 2016:101; Mythen and Walklate, 2016). 'Norms and imperatives that guided decisions in the past [can be] re-evaluated and questioned through the imagination of a threatening future. From that follow alternative ideas for capitalism, law, consumerism, science' (Beck, 2015:83).

It is in this way that dystopian/utopian or apocalyptic literature can be a call to action, a 'call to be rational at last' (Latour, 2017: 218, italics removed).

> Once we move away from the present, from how things are now, we enter this realm of possible worlds. We find the idea of creating fictional worlds and putting them to work fascinating. The ones we are most interested in are not just for entertainment but for reflection, critique, provocation, and inspiration. Rather than thinking about architecture, products, and the environment, we start with laws, ethics, political systems, social beliefs, values, fears, and hopes, and how these can be translated into material expressions, embodied in material culture, becoming little bits of another world that function as synecdoches. (Dunne and Raby, 2013:70)

As such within literature and narrative, there are many types of ways to tell a story. This thesis discusses the use of 'fiction' and I will elaborate further on three types of it, called genres: science, history and climate. Science fiction (sci-fi), a genre 'notoriously difficult to define', looks at scientific exploration, rationalist logics, perceptions of science, and the way they are changing or may change the world (Vint, 2014; Greenberg, 2017). It is a genre of *ideas*, and rather than finding new ways to describe reality, looks to envision new futures, often generating 'profound philosophical questions' about where we are headed (Thompson, 2008). Historical fiction is another genre, where the plot and setting are instead in the past.

However, this type of fact-based writing can extend to the future as well, as is illustrated by several notable historians such as Naomi Oreskes and Erik Conway discussed in Chapter 3. Climate change fiction (cli-fi), is an interesting emerging genre that explores the newly unsettled relationship between nature and society, and intertwines the past, present and future. 'The complexity, invisibility and future dimension of climate change raise several questions of uncertainty' and as such, these works of fiction can be a source for reflection, for communicating and analysing these complex emerging risks, and for highlighting which risks need to be taken seriously (Mehnert, 2016:223). I argue that together, these ways of envisioning alternative futures present many possibilities for communicating digital risks. Mixing creativity and fiction with academic ideas, theories and concepts for exploring the future may be necessary for identifying and analysing them. I thus argue for an integrated approach that is creative and 'collegiate' (Thompson, 2018); an *academic* fiction that blends 'the sciences, the arts, the humanities and the physical/experiential' into an integrated experience that is 'exploratory, multidisciplinary, interdisciplinary and global' and blends knowledge, theory, skills and creativity (Lueddeke, 2019:218). Through this, we can create shared 'visions of the

future and the technologies that might help shape it' (McCray, 2013:16) by discussing the risks that await there.

In particular, fiction can help in two critical ways, by identifying the values at risk from digitalisation and in creating and exploring potential consequences of solutions (Milkoreit, 2017:1-2). Fiction can thus draw from something scientific inquiry has long drawn from: *possibility*. Such works should be 'based on real science; focused on social, cultural, ethical, and political implications; interested in using stories to aid reflection; yet without sacrificing the quality of storytelling' (Dunne and Raby, 2013:78). Using stories to envision the future and generate discussion about it is essential, because this means the invisible and immaterial nature of digital risks cannot be considered an excuse for inaction or non-decision (Beck, 2009b:299). It is through fiction that envisioning the digital risks of the future becomes possible, that we gain new insight into the future, so that we can "start taking the *present* seriously at last" (Latour, 2017: 219, italics in original).

Digital risks are fundamentally different than many other types of risks- they linger only in a greatly unknown and potentially long-term future, one without clear parameters or boundaries, which stretches across a limitless expanse of time and space. They lurk insidiously, and the more dangerous they come to be, the more invisible they become. While criticised for being a way to further abstract (Taleb, 2012), or as an 'inaccurate' way to communicate risk (Cho and Friley, 2015:1), I argue that this is specifically why stories are needed for communicating digital risks. Despite their unclear and uncertain nature, digital risks are still essential to discuss. People have a normative right to make essential decisions about the direction of the future, to actively shape their own destinies (Dunne and Raby, 2013), and to be offered means for actively transforming through a digital metamorphosis (Beck, 2016). To begin these critical discussions, I assert that we need to use a story- one that challenges us to reflect on possibility- a narrative that helps us to '*dream differently*' (Beck, 2010:262, italics in original).

2.3 Summary

My research question asks: *How can digital risks be communicated?* In order to answer it, I began by defining the concepts within digital risks. I argued for a constructed view of the future, uncertainty and risk and defined risk as the negative effect of uncertainty on one's values, determined by probability and impact. I argued that risk is subjective, based on perception and value, and becomes as such a powerful concept in a society preoccupied with risk. I discussed this society as Ulrich Beck's risk society, whereby processes of reflexivity create new risks in

the face of the attempt to control risk. Globalisation means that risks can be redistributed across temporal and spatial boundaries. Building on this, I answered my first sub-question: *What are digital risks?* I defined and provided several examples of digital risks: the immaterial, uncertain, and unknown risks caused by increasing digitalisation and developing of advanced technologies. These risks are challenging because the more problematic they become, the more invisible they may become as well. As technology is used to solve this and other challenges, we enter into a digital risk society, where both the failure and success of institutions perpetuates further digital risks. I provided a general overview of where we are headed in terms of these new technologies, and in particular highlighted the progress that marks that Fourth Industrial Revolution. I contrasted this notion of a revolution with Beck's hope for a digital metamorphosis: an active transformation where rather than being shaped by technology, society is the one to shape it.

I then answered by second sub-question: *What is significant about the communication of digital risks?* I highlighted three general steps in the risk management process: identification, analysis, and communication. I asserted that for digital risk, the communication process is significant, because it needs to be communicated while still in the identification or analysis phases, which defies the notion that risk can become certain, calculated and controlled. I discussed the precautionary principle, a method which also embraces uncertainty, and explained the concerns and possibilities of it. I asserted that to approach digital risk requires a fundamentally different mindset and method than that which created it; I advocated for one where the goal is not to improve accuracy and certainty, but to instead facilitate questions and discussions that build on the inherent uncertainties of digital risks.

I then answered my third-sub question: *What possibilities are there to communicate digital risks?* I asserted that the problem lies in the simplification process, which leaves out details that can become important to consider when facing the unknown. I asserted that the technological revolution is not one that needs to be followed blindly, but leaves room for social changes and transformation. I argued for a change in mindset which works against the modernity cycle. Storytelling, which embraces uncertainties of digital risks and explores them anyway, is discussed. They allow risk to be perceived not as a problem but rather as a part of imagination, one in which new problems and solutions can be actively discussed before they are apparent in society. I expanded upon the various types of storytelling; namely, apocalyptic discourse; utopian/dystopian writing; and science, historical and climate change fictions. I argued that drawing from these can help to create academic-based fiction- fictional stories based on facts and theories- which can communicate digital risk.

3. Methodology

"Why should I want to make anything up?
Life's bad enough as it is without wanting to invent any more of it."
- Marvin (The Restaurant at the End of the Universe, written by Douglas Adams: 1980)

Overview

In the previous chapter I answered all three sub-questions for my research question: *How can digital risks be communicated?* Theoretically, I answered this by presenting my argument that fiction can be used to communicate digital risks. The next step for this thesis is thus a practical discussion of this. In order to argue for the use of fiction as a messenger for communicating digital risk, I use a case study example which demonstrates how an academic message can be communicated through a story. The case I use creates academic-based fiction on the digital risks that may occur from using advanced technology to make decisions regarding climate change. Here I discuss the methods I employ to develop my case and conduct my analysis. In particular, I elaborate on the decision to write my own short story.

This includes an explanation of the preliminary fieldwork I conducted in Svalbard; the use of articles and reports for the real uses of and the deeper workings of these technologies; and the inspiration drawn from other academic story writers such as Asimov, Harari, and Oreskes and Conway. I explain my motivation and process for writing my own story. An important element of generating my own 'data' for a case study entails the discussion of validity. I thus explain my sources and process, including biases, ethics, and limitations for my methods. I conclude this chapter with an overview of how I in turn use this data and analyse it.

As I discuss, I am not able to conduct a holistic analysis of the case study where I examine all aspects of the risk communication process (Lundgren and McMakin, 2013). In my analysis, I examine the 'message' portrayed through the 'messenger'; I do not examine how it is received. To analyse the message, I explain the digital risks intended to be discussed through the use of this fictional short story as the messenger.

3.1. Case Study

A case study is used to thoroughly understand a problem for a given topic, and involves a choice of what is to be studied (Creswell, 2007:74-75 citing Stake, 2005). A case study encompasses gathering in-depth data to thoroughly explore one or multiple cases. This includes multiple sources such as interviews, observations, documents, articles and report reports (Yin, 2003). The case that is selected is presented descriptively before it is analysed and can be found in qualitative (more descriptive) or quantitative (more numerical) research (Bryman, 2016). There are many possibilities for using such an approach. While multiple cases can be used to illustrate various perspectives on the issue being studied, this thesis uses a single case.

My case study functions as an illustration or example of the way digital risk can be communicated, and while researchers can be weary to generalise from a case (as it is specific to a context), if it is a representative case, it can nevertheless be used to this effect, as well as to draw themes and conclusions that can be discussed theoretically (Creswell, 2007). For my research, I constructed my own data, using a short fictional story as my data. To do this, I included extensive preliminary data gathering, including fieldwork, document review, and the examining of other works of academic storytelling. Given this, I aim to be very transparent in how I created my story and how I conducted the case study, all of which will be addressed in this chapter.

3.2. Preliminary Data Gathering

This section entails the foundational components of my story and case study. Because my data is self-generated, this section refers to the 'preliminary' data, or the information and processes that were used as influence to construct the actual story used in my analysis. I begin with outlining the fieldwork conducted in Svalbard including the methods used. Next, I outline the articles and reports that were of greatest influence, including their sources. Finally, I briefly discuss three works of academic storytelling which served as the greatest influences in the justification for writing my own short story.

3.2.1. Fieldwork

I knew early on that I would construct my own short story for the case study. As discussed, with narrative, the focus changes from *what has actually happened* to *how people make sense of what happened* (Bryman, 2016). 'Knowing from whose perspective a problem is being addressed and engaging them in problem formulation is necessary to frame the focus, level, and

scope of a research study' (Van de Ven, 2007:73). Furthermore, it follows from the process of abduction, the grounding of people's worldviews in theory (Bryman, 2016), which will all be elaborated on in section 3.3. Once this decision was made however, in terms of the research process, I determined that it would be important to gain perspectives outside of my own in order to get an 'honest story told honestly' (Flyvbjerg, 2001:137 citing Geertz, 1988). Due to feasibility, the natural limitations of funding and time, and the previous experience I had gained during my graduate study there: I decided on Longyearbyen, Svalbard as my location of field research. I decided to use a 'pragmatic' approach and would travel to Svalbard with the goal of meeting people on 'chance encounters' (Creswell, 2007:119).

I travelled to Longyearbyen to begin my fieldwork (RiS ID: 11127), where I was given a position as a Guest Masters Student at the University Centre in Svalbard, and for several months I had access to my own desk and swivel chair, unlimited coffee, and great conversation: courtesy of the Arctic Technology Department. The pragmatic approach I took required a great deal of flexibility as this type of research is just as much science as art (Wolcott, 1995; Perecman and Curran, 2006:58-60). By not having a set schedule, I made myself more available in the field, and could engage in natural conversations and relationship building: elements which make fieldwork experiences rewarding and important (Mishler, 1986; Reissman, 2001).

Unexpectedly, simply being immersed in the Arctic environment turned out to be of true value and inspiration in itself; given my previous time spent in Longyearbyen, I was able to witness for myself the many new changes already taking place, such as the increase in cruise ship traffic and the building of new hotels. I also travelled out into the fjord, where I was able to compare photos from my previous visit and see for myself the receding of ice in just about a year's time. While I was in Longyearbyen, I met with several locals and learned of their interesting perspectives of the changes occurring in Svalbard.

I gained valuable insight from people with a variety of backgrounds, whose stories I interpreted and catalogued at the end of each occurrence in a digital journal. I encountered people who were excited about the many new changes taking place and the economic opportunities. I also met many who stated they were apprehensive about the changes, and felt frustrated at the lack of ability to shape the changes occurring at such a rapid pace. Ultimately, this experience proved very valuable for my writing, and demonstrated a complexity of progress: the many sides and perspectives of risk. In hearing stories of life in such a rapidly changing landscape, I would be able to write my own through the scope of *what digital risks might occur from using technology to make decisions about climate change*.

3.2.2. Articles and Reports

In order to examine digital risks in this scope, I needed to create a strong factual basis for what this scope actually entailed. I thus looked to the Intergovernmental Panel on Climate Change (IPCC), a scientific body under the United Nations that assess various aspects of climate change. In their most recent report (2018), *Global Warming of 1.5 °C,* they examine the 'impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change.' (IPCC, 2018). I examined this report with the aim of discovering if and to what extent advanced technologies were being used in gaining insight or making decisions regarding climate change. While some technologies were outlined, it was not clear to what extent information was being generated from them and how those results influenced decisions. While I could verify that technology was indeed being used, in order to discover *how* advanced technologies were involved in climate change decisions, I needed to find another source.

I thus examined an article from 'The Download': published by Michael Reilly (2017) on MIT Technology Review, a website founded by the Massachusetts Institute of Technology (MIT) to explore new technologies and their impact. The article, *Climate-Change Research Is Getting a Big Dose of AI,* was a brief article that stated three areas were benefiting the most from AI technologies; namely, through machine-learning, which was being 'trained on data from extreme climate events' to identify areas of potential risk; through using AI to analyse the models the IPCC uses to investigate climate change and the results they produce; and by using it to predict severe weather (Reilly, 2017 citing Liu et al., 2016). The article then linked to a larger article called *Machine Learning Tapped to Improve Climate Forecasts* by Nicola Jones (2017).

This article from the academic journal Nature, provided additional insight. While it asserted that some climate research is still using more conventional methods and technology, that research is increasingly using AI in order to improve forecasts, particularity as the amount of available data grows. It outlined the process of how tremendous amounts of data can be interpreted through algorithms, and that through deep learning, algorithms set their own parameters to determine what of that data isn't important, what is, and how important it is (Jones, 2017). Alongside the other general research which was discussed in Chapter 2, this formed a strong basis for the data-science components of my short story, and enabled me to determine that advanced technology may come to be used more and more to make decisions about climate change. I could thus consider the digital risks that may be caused by this use of technology, as it had sufficient basis in real-world events to be further explored through fiction.

3.2.3. Academic Storytelling

I briefly discuss three works of academic-based storytelling in this section, which served as large influencers for writing my own short story and as a justification for this type of writing.

First, is Isaac Asimov's 1950 collection of short stories, *I, Robot.* Asimov is a well-known science-fiction writer, who is arguably most notable for creating the 'Three Laws of Robotics' (Asimov, 1950). Detailed in the short story *Runaround*, these laws are; first, 'a robot may not injure a human being or, through inaction, allow a human being to come to harm'; second, 'a robot must obey the orders given it by human beings except where such orders would conflict with the First Law'; and third, 'a robot must protect its own existence as long as such protection does not conflict with the First or Second Laws' (ibid). This story is important because, while based in science-fiction, these rules have had real impact, and are used to some extent to govern the development of advanced artificial intelligence and robotics today (EP, 2017:6). In terms of content, a second story is of interest from this collection: *The Evitable Conflict.* It presents a central idea I used in constructing my own short story: given these laws and the destructive human behaviour on the earth which it depends on for life, machines with greater understanding of Earth's complex systems would possibly determine that to keep a 'human being from coming to harm' they would need to prevent this destruction (Asimov, 1950). In this short story, the machines determine that the only way to fulfil the First Law is to take control of humanity, a notion which underlies my own short story.

Second, is *Homo Deus: A Brief History of Tomorrow* by Yuval Noah Harari. While the entire novel is not relevant to this thesis, there are several aspects that proved to be of importance. While this novel is non-fiction, it places great importance on fiction and storytelling. 'History isn't a single narrative, but thousands of alternative narratives. Whenever we chose to tell one, we are also silencing others' (Harari, 2017:176). He describes fiction as a 'vital' way of making sense of the world (ibid:177-179). Digital risks lie in a world where the 'lines of fiction and reality become blurred' (Beck, 2016:103), and Harari's novel argues that being able to distinguish between fiction and reality is essential. The closer science comes to stories of science-fiction, the more risk may indeed become a challenge of the imagination (Beck, 2009b; Hulme, 2009; Mehnert, 2016; Milkoreit, 2017). This novel was influential because of the way it presents potential digital risks using abductive reasoning, and how it makes academic arguments by presenting scenarios for things like a data-driven future, the consequences of using AI to make decisions, and humans that incorporate biotechnology into their own bodies.

Lastly, is *The Collapse of Western Civilization* by Naomi Oreskes and Erik Conway, which has served as an important basis for my understanding of *academic* fiction, as outlined in Chapter 2. These two authors create a compelling fictional story, that while set in the future, is nevertheless based on academic facts and theories. It incorporates historical and current real events, places, institutions and even people, all as 'historical', and launches a greater story about how 'climate change' shaped the viewpoint of the story. It includes academic concepts and theories relevant to climate change, such as adaptation and the Anthropocene, and is largely a call to reflect on the role of science, scientific work, and scientists in society: particularly as these are used in a variety of ways to justify certain interests and achieve certain goals (Oreskes and Conway, 2014). Conceptually, the ability for a story- based on sound academic facts and theories- to construct a scenario of the future which calls attention to risks and the need to revaluate the actions of the present to avoid them, is important for this thesis. It is through this particular story that I find a fascinating mix of the past, present and future, which offers new possibilities for using academic fiction to communicate digital risk.

3.3. Narrative Construction

I will now discuss two very important aspects of creating my own 'data' for a case study: namely, the why and the how of writing my own story. I explain the motivation and justification for writing my own story rather than using excerpts from others as is often done (see Mehnert, 2016; Milkoreit, 2017: Arnold, 2018), or 'restorying' (Creswell, 2007: 56) the narratives from Svalbard. I then detail the process for writing my story through abductive reasoning.

3.3.1. Motivation

The reasoning behind writing my own story, rather than using excerpts from another story to analyse was a simple one: as I researcher I wanted to not just examine the theories on communicating digital risk through fiction, but also to learn through practice about the process of writing to communicate digital risks. Risk communication follows from the traditional model of communication (Lundgren and McMakin, 2013 citing Shannon, 1948). Adapted for this case, I would need to assess how one take the theories and concepts from academia into a creative world and communicate them. Figure 1.1 explains this as a generalised process on the next page. In Chapter 2, I answered how digital risks can be communicated theoretically. Inherently, this means the focus of communication was on the 'how' or the mechanisms by which the communication can occur: the 'messenger' (Lundgren and McMakin, 2013).

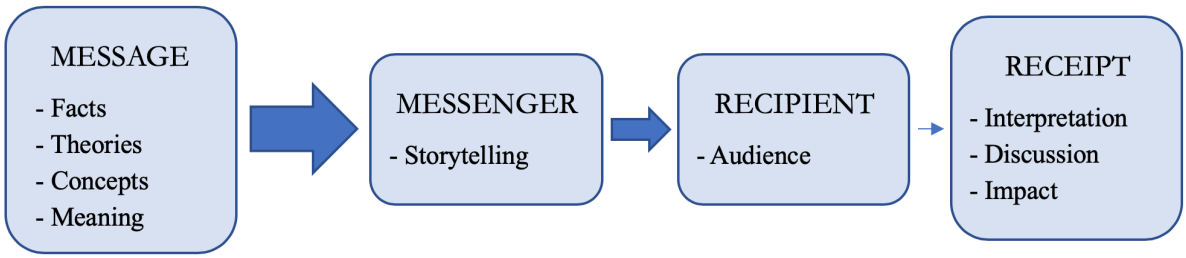

Figure 1.1

My motivation for writing my own short story was thus to engage with the 'message', seen above as that which informs the story. In terms of digital risk, 'what' they might be is an uncertain notion, and even unknown or invisible. This means that the message that is being communicated is also relevant, not just how it is communicated. By writing my own short story, I could engage further with the process of communication, and experience the mechanisms at work which create the message the story portrays (ibid). As I discovered with *Homo Deus*, academic work and non-fiction may offer a rational explanation of potential digital risks, but because these risks are highly unknown and uncertain, such a way of communicating them makes them easy to criticise and disagree with (Dutton, 2016). Like Oreskes and Conway's story, I aimed to experience how a risk practitioner could build from academic facts to make the uncertainties of digital risks their strength instead of weakness, through fiction.

3.3.2. Process

While I am an avid reader myself, and remember loving to write creatively as a child, writing this short story proved an almost insurmountable task. I strongly underestimated how difficult it would be to employ both analytical and creative mindsets in the same piece. I began with a wealth of information; academic concepts, theories, and articles; industry news articles and reports; fieldwork notes from stories and discussions in Svalbard; as well as many other academic fiction writings like that discussed above. The process of combining all these into a story was eventually achieved through abductive reasoning.

In *A Theory of Semiotics*, Umberto Eco (1976) states that abduction is a type of inference, 'where we find some very curious circumstances, which would be explained by the supposition that it was a case of some general rule, and there upon adopt that supposition' (Eco 1976:131 citing Pierce 2.624). It is used to create explanation: to craft a new rule to explain what would otherwise be mysterious. It consciously makes the logical fallacy of affirming the consequent (Eco 1976; Gell, 1998), because while the explanation may seem logical, there are other logical possibilities as well. For example, the logic: if the phone is broken, then the screen

will be black. Abductive reasoning finds the screen black, and determines that the phone must be broken. The reason it is a fallacy, is because there are other logical explanations for the screen being black, such as it is turned off, or it ran out of battery.

This way of thinking can also be considered as jumping to conclusions or as *misinterpretation,* but what should be taken from this is the idea that rather than a *mis*interpretation, when engaging with the unknown, it opens us up for *many possible* interpretations, including sparking new interpretations and ideas that may have been unintended. Abduction is important for storytelling, because for example, a woman listening to music hears the music, but also understands something more than the 'meaning' of each individual lyric, note or sound; it is from the 'combination' of the sounds where new meanings are found, and can vary depending on the listener. (Eco, 1976:131-132). This means the message must be fluid and made available and open for interpretation.

Digital risks are challenging also because they fall within a digital risk society: which means there are challenges related to the digital mediums used to communicate. Thus, to communicate digital risk, one needs to be aware of how messages are communicated and received: that 'everybody is "speaker" and "audience" at the same time' (Beck, 2016:95). While this opens up opportunities of agency- more people can have a voice and more people can listen- it means that messages can be muddled by the sheer volume of messages being sent and received. Thus, having a message, even one that is as unclear as those found within digital risk, is important. 'We are all in danger now and have a new everything to face, and there is no point gathering an audience and demanding its attention unless you have something to say that is important and constructive' (Lamott, 1994:108).

To write a message for academic fiction, I thus needed to draw inspiration and information from many sources. As discussed, this included extensive preliminary data gathering, which helped me to determine my scope: the digital risks that might occur from using advanced technology to make decisions around climate change. I needed to conduct additional research on the theories and concepts within this scope, which I explained in 3.2. but which also required me to study outside of my discipline and in the fields of environmental science, human geography, data science, and science and technology studies. During this research, it was through abductive reasoning that I was able to engage in scenario planning and imagining different futures.

The message I formed was a result of this process, which is discussed in full in my analysis in section 4.3.

3.3.3. Results

The following is a synopsis of the short story, *The Risk Manager*:

After the Era of the Anthropocene, the threats of climate change have been managed and mitigated due to one robotics company's advances in artificial intelligence. From these results, the technology successful in aiding humanity has become required use in all organisations across the globe, to ensure humanity doesn't turn down such a destructive path again. The general population in not aware that these algorithms have been developed alongside and incorporated into advanced robotics technology, the combination of which are intelligent, learning machines that look like regular people. These machines are Risk Managers, networked algorithms in physical robotic bodies that have permeated every organisation, influencing decision-making to keep humanity in the Balance. But trouble is stirring. A political party lead by an ex-engineer for the very robotics company credited with saving humanity is determined to destroy all Risk Managers and return control of the future back to human beings. This short story follows the account of one such Risk Manager, faced with responding to this emerging threat and who must discover how to respond while keeping humanity from a path of its own destruction.

3.4. Validity, Ethics and Limitations

In writing my own story, I have naturally struggled with issues of validity, bias, ethics and limitations. Given the inherent difficulties of constructing a strong and valid study such as this, in this section I aim to achieve full transparency with my audience, including the validity and reliability of this thesis, my possible biases, ethical concerns, and limitations for using these methods. The goal of this is to gain sufficient evidence towards reasonable credibility, and to instil confidence in the observations, interpretations and conclusions of my work (Creswell, 2007**:**204). My aim in gathering preliminary data as I have detailed: the use of fieldwork, articles and other works of fiction have functioned to improve the validity of my story. I will thus discuss each of these individually in relation to validity, ethics, bias and limitation, and conclude with how together, they allow my case study to be considered a valid one for further research.

My preliminary data gathering during my fieldwork in Svalbard followed the Norwegian National Research Ethics Committee's 2016 research guidelines (NESH, 2016). I provided all individuals I engaged with, with 'adequate information about the field of research, the purpose of research, who has funded the project, who will receive access to the information,

the intended use of the results, and the consequences of participation in the research project' (ibid:13) At the beginning of my conversations, I informed individuals about my research and the purpose of my study, conveyed to them that if they wanted to share their stories with me, that it would be anonymous and act solely as inspiration. I also conveyed that they had full ability to refrain from taking part. Given that the stories shared with me served as inspiration rather than primary data, I did not gain documented consent from any of my participants. This was justified by the fact that my research was very general in nature, including general observations and conversations in open settings and public spaces. It was thus advised by the Committee that I instead needed to 'take particular care to comply with respect for human dignity and protection of individuals.' Furthermore, my records contained absolutely no personal, private or identifying material of any kind, and as such I worked diligently to protecting the integrity, dignity, privacy of the individuals I engaged with in Svalbard.

Nevertheless, listening to the stories of other's entails inherent and unavoidable biases. After all, stories and messages are not neutral: 'certain aspects of the story are emphasised and other aspects are downplayed and ignored' (Hulme, 2009:226). Scenarios in general always present particular assumptions and are not 'neutral or unambiguously true' (Mehnert, 2016:5). I have asserted that this ambiguity is a strength of storytelling and makes it actively open to interpretation: a process which was precisely what I aimed to explore in this thesis. However, creating validity is an important aspect of research; it was clear I needed to incorporate other sources to achieve this. I thus included written documents by way of articles and reports: three of which I outlined in this chapter. However, there were many other articles that were involved in the forming of my theories and ideas in Chapter 2 and Chapter 4. Nevertheless, I only incorporated sources that would be considered valid and reliable enough for academic work, this means the use of sources that are rigorously checked or peer-reviewed, have strong ethical codes of conduct, or are considered academic in their own right.

The first document I discussed in this chapter was the IPCC report, *Global Warming of 1.5 °C* (IPCC, 2018). The IPCC is a prominent scientific/policy panel that produces notable works of science (Hulme, 2009:95-99; Maslin, 2014). While at times contested, (ibid), given their rigorous process for selecting authors and editing work, they are considered an academic source for this thesis. Second was the MIT Technology Review article, *Climate-Change Research Is Getting a Big Dose of AI* (Reilly, 2017). This news source is owned by the Massachusetts Institute of Technology, a renowned university for research and education. While they remain independent in terms of journalism, they are very transparent, explaining in detail their code of conduct for their writers, among other essential facts such as the influence

of advertising. While this source is considered a news article, the author Michael Reilly is the Deputy Editor, and given its publication on this cite with high transparency, has been considered valid. Third was the article in Springer's academic journal Nature (Jones, 2017), *Machine Learning Tapped to Improve Climate Forecasts*. This is an academic journal from an academic publishing company with peer review, and as such is considered an academic source.

To further examine how to combine this preliminary data- narrative and academic in form- I included the review of three pieces of 'academic' storytelling that I could draw various types of inspiration from; conceptual, contextual, by example etc. The three pieces I used were; Isaac Asimov's short story collection *I, Robot*; *Homo Deus: A Brief History of Tomorrow* by Yuval Noah Harari; and *The Collapse of Western Civilization* by Naomi Oreskes and Erik Conway. Given the fictional/scenarios bases for these works, I could not analyse the validity of the stories themselves, so I needed to analyse the trustworthiness of the authors.

Isaac Asimov (1920-1992) is a celebrated Russian-born American author, who obtained his PhD from Columbia University (USA). In addition to authoring almost 500 books, he was professor of Biochemistry at Boston University. His fiction is extremely well-known and his ideas have been used to this day to govern robotics development (EP, 2017:6), which alongside his academic background, make him a trustworthy author. Yuval Noah Harari (1976-) is an Israeli author, who obtained his PhD from the University of Oxford (UK). He is a professor of History at the Hebrew University of Jerusalem. His academic background, success as a contemporary author and his books becoming international bestsellers, leads me to conclude that he is also a trustworthy author. Finally, are the authors Naomi Oreskes and Erik Conway. Naomi Oreskes (1958-) is an American author, who obtained her PhD from Stanford University (USA). She is a professor of the History of Science and an affiliated professor of Earth and Planetary Sciences at Harvard University (USA). Erik Conway (1965-) is also an American author, who obtained his PhD from the University of Minnesota (USA). He works as a Historian at NASA's Jet Propulsion Laboratory at the California Institute of Technology (USA). They have written together previously with notable success. Their academic backgrounds and previous successes make them trustworthy authors as well.

Finally, in terms of bias, for constructing my own fictional story, and as discussed in 3.3., it is with purpose that prior research and academic works have influenced my writing. 'Using theory has some inherent limitations in that researchers approach the data with an informed but, nonetheless, strong bias' (Hsieh and Shannon, 2005:1283). Since the very aim of this case study is to provide an example of academic-based fiction, this creates a bias on purpose. I use a case study to illustrate my argument that fiction can be used as a messenger of

and mechanism for communicating digital risk: that it can be used to generate discussions on the values and perspectives involved for progressing into the future. While I argue that it *can* be a method, I am not able to elaborate on this argument fully, to determine if these discussions are meaningful or effective. This limitation is discussed further in the next section.

Overall, I recognise the challenge for creating sufficient validity when constructing my own story and using it to demonstrate my own argument. However, I incorporated several additional perspectives and sources with the aim of making this short fiction story as valid *academically* as I could.

3.5. Data Analysis

There are many different ways to analyse a case study. Due to the limitations of this thesis in terms of character count and time, I could not complete all aspects necessary for reviewing the full case. Specifically, I am only able to present the short story as an example of how fiction can communicate digital risk. The 'Theories and Concepts' (section 4.1.) represent, along with previous theories discussed in 'Digital Risk' (section 2.1.), the academic components that went into writing the short story itself (section 4.2.). This is 'The Message' (section 4.3.), where I explain the digital risks that are intended to be discussed from the story. While I have theoretically answered my research question in Chapter 2, and asserted that fiction can be used to communicate digital risk, in order to practically assess if this particular story does and how effectively, would entail further research. Ideally, I would have been able to engage with a target audience to determine their feedback and discover if such risks were accurately communicated or not (Lundgren and McMakin, 2013).

As I demonstrated in Figure 1.1. (in section 3.3.) and as I discuss further in 'Next Steps' (section 4.4.), this research needs to be continued to determine how the story is received and if the digital risks intended to be discussed are also discovered by the target group or not. Additionally, discussion on what kinds of other risks might be found and what kinds of different perspectives generated needs to also be analysed. If the story does not generate discussion around the digital risks intended or unintended, then the material would be continually worked on until the target audience did so. Because of this limitation, I cannot take a 'holistic' approach to analysing the case, which would examine the entirety of the communication process as displayed in Figure 1.1.: from creating the message to its reception. Instead I must take an 'embedded' approach, where I analyse certain aspects of the case, which for this thesis is mainly revolves around the message (Creswell, 2007:75).

3.6. Summary

In Chapter 2, I answered my research question: *How can digital risks be communicated?* In this chapter, I explained the methodology I use for a practical case study to examine this question. I began with a brief explanation of case study research, and explained that I will use a single case. To create validity for my own story, I explained how I conducted extensive preliminary data gathering. This included fieldwork in Longyearbyen, Svalbard. During this time, I determined the scope of my case: the digital risks that may occur from using advanced technology to make decisions about climate change. To examine this scope further, I detailed the academic articles and reports used to assess the role technology plays in climate change decisions. Next, I discussed the inspiration drawn from other 'academic' story writers, including Isaac Asimov, Naomi Oreskes, and Erik Conway; as well as the non-fiction scenario-based work from Yuval Noah Harari.

I then detailed the motivation for writing my own short story, in order to examine the construction of the 'message' as well as the use of fiction as a messenger. I highlighted the challenging process of incorporating academic sources, theories and concepts into a creative short story, and detailed that I achieved this through a process of abductive reasoning. In 3.2.3., I included a synopsis of the short story I constructed, titled, *The Risk Manager*. In building from academic theory and concepts, as well as incorporating fieldwork, articles and reports, and other writers, I detailed the challenges to validity, ethics, biases. I discussed each source outlined in my preliminary data gathering, and provide a detailed explanation of why they are considered trustworthy for this thesis.

I also outlined the constraints for my research based on its design. In particular, I discussed the severe limitations faced for the contents of exploring this research fully. The largest limitation is that, given the time and space constraints of the thesis, I am not able to conduct a holistic analysis of my case study, where I examine the full process of communication highlighted in 3.3. Instead I complete an embedded analysis, which examines only certain aspects of the case study. In this case, Chapter 2 was dedicated to providing a theoretical argument for using fiction as a messenger of digital risk. Chapter 4's 'Case Study Analysis' then examines the message itself, and acts as an example of my argument. The limitations are thus that I am not able to analyse the communication process results: how the message is interpreted by different audiences and the impact it may subsequently have on the recipients. Thus, to assess how effective such a communication method is, would warrant further steps of the research process that are outlined in 4.4.

4. Analytical Discussion

"I am putting myself to the fullest possible use,
which is all I think that any conscious entity can ever hope to do."
- HAL (2001: A Space Odyssey, directed by Stanley Kubrick: 1968)

Overview

Theoretically, in Chapter 2, I answered my research question: *How can digital risks be communicated?* I presented my argument that fiction can be used to communicate digital risks. This chapter functions as the practical case study analysis, within the scope of conveying digital risks that may come from using advanced technology to make decisions about climate change. In this chapter I build on the theories outlined in Chapter 2 such as a risk, risk society, and digital risk society. I also elaborate on new theories and concepts relevant: these are not included in the theoretical discussion of Chapter 2, because they are only here, as the Anthropocene and planetary boundaries.

I use these to discuss the academic message from the short story which is then presented in full. This short story, *The Risk Manager*, presents a science-/climate-fiction of an extreme scenario where the decisions about the future are being made by advanced technologies. They have developed the capacity to understand Earth's complex systems and have thus been deployed to help humanity respond to climate change. The result is that humanity has transferred decision-making power, as well as control of the future in full, to artificially intelligent algorithms. In communicating digital risk through this story, I aim to make them socially experienceable, all while recognising the inherent uncertainties, unknowns, ambiguities and invisibilities that make this category of risk especially challenging.

After the story, I explain the intended message: the digital risks and the mechanisms that could cause them. I assert that due to the inclusion of technology into decision-making and daily life, the traditional political institutions which held definition power (Beck 2009a; Beck, 2010) for decision-making regarding risk, have now become indistinguishable from the techno-

economic ones. The result is that many climate-related decisions are being made mediated by advanced technology. A power shift thus occurs, where technology gains power over humanity as the mechanism through which humans engage with, construct and understand the world.

This embodies a 'digital risk society' (Lupton, 2016), which through efforts to reduce climate related-risks, reflexively generates new, invisible, immaterial- risks in return (Beck, 2010; Beck, 2016). By using this case study, I aim to demonstrate how fiction can be used to communicate digital risks. I conclude providing the next steps necessary for this study; namely, the second half of the communication process, or how the message is received. I assert that the next steps would be to engage with a target audience and to assess how the points from the story are received, what kind of digital risks are discovered, what kinds of discussion are subsequently had, and what kind of impact did it make. Overall, I continue my argument that despite their uncertain, invisible and speculative nature, digital risks are extremely important to discuss and be aware of, and that the use of fiction to communicate them can greatly facilitate their identification, analysis and discussion.

4.1. Theories and Concepts

This case study aims to use a short story to construct an academic message of the digital risks that might be caused by using advanced technology to make decisions about climate change. As such, there are several new academic concepts which need to be outlined. They are not used in detail in the rest of the thesis, where the overarching argument is to use fiction to communicate digital risk. I have thus decided to include them here, where they are most relevant and will add to, rather than muddle my overall argument. The concepts I introduce below are: the Anthropocene, climate change, mitigation, adaptation, climate risk, and the current intentions and uses of technology to understand and make decisions regarding climate risks.

The Anthropocene refers to the time period when human activities began to fundamentally shape the 'natural' environment of Earth (Steffen et al., 2004; Maslin, 2014). As this thesis is rooted in Beck's theory of the risk society, it considers this mainly as the result of the unintended effects of progress, beginning with the Industrial Revolution (Maslin, 2014:6). 'The second half of the twentieth century is unique in the entire history of human existence on Earth. Many human activities reached take-off points sometime in the twentieth century and have accelerated sharply towards the end of the century. The last 50 years have without doubt seen the most rapid transformation of the human relationship with the natural world in the history of humankind' (Steffen et al., 2004: 131). It marks an age of extremes: extreme weather, extreme growth, extreme population, and it is both the scale and the speed of change that mark

the Anthropocene as an era of 'great acceleration' (Steffen, et al., 2015 citing Hibbard et al., 2006).

Such extreme growth across a variety of social factors and industries has caused anthropogenic climate change, or changes in the climate caused by human activity. Climate change is an exceedingly complex topic in almost every way: socially, economically, environmentally, politically. Ecologically, for example, climate change represents the negative side effects the industrial revolution has on the environment. This includes tremendous pollution, environmental degradation, rising sea-levels and higher temperatures around the globe (Hulme, 2009; Maslin, 2014; IPCC, 2018). These effects are understood to be the result of specific gases called 'greenhouse' gases; such as, carbon dioxide, methane, and nitrous oxide, that are being emitted into the air at an unprecedented rate since the Industrial Revolution began. The result of this is so profound that it is changing the composition and processes of Earth's systems, such as its atmosphere and bodies of water (Maslin, 2014).

One important notion to mention here is that of planetary boundaries, the idea that there are thresholds or upper boundaries that humanity can safely operate in while not exacerbating or create new extremes for the Earth (Rockström, 2009; Maslin, 2014:165-169; Raworth, 2017). Others suggest ideas of 'donuts'- which include upper *and* lower boundaries- so rather than, for example, continuous industrial growth without any limits, or perhaps or no growth at all, it proposes a threshold in which humanity can live without disastrous environmental side effects: *a balance.* Such extreme changes can cause problems for humans like drought, flooding, and starvation. Humanity relies on Earth not just as a thing under one's feet, but for every aspect of survival. 'Peaceful co-existence between humans and nonhumans, between society and nature, is perfectly possible, indeed in many parts of the world and in many epochs the rule and not the exception, as the history of human societies documents.

Whether or not that co-existence will continue into the future is a question that in a large part will be decided by the role played by technology in a globalized world' (Vetlesen, 2015:156). Such extreme changes create new climate-related risks or climate risks (Adger and Nelson, 2010). These risks represent global risks that are reflexive and redistributed spatially and temporally (Beck, 2010; Beck, 2016). Such fluidity is an inherently tricky challenge to the rather rigid institutions that exist to govern humanity currently (Smit and Wandel, 2012). It is also a matter of opinion: different groups of people believe there are different ways that constitute *the right* way to govern, each with their own view of what the future should be (Hulme, 2009).

This notion of 'the "who" and the "how"- of climate governance' (ibid:304), become the very basis and most fundamental of dilemmas for moving forward. 'How the Anthropocene is interpreted, and who gets to invoke which framing of the new human age, matters greatly both for the planet and for particular parts of humanity' (Dalby, 2015:33), and it forcing us to 'examine the whole basis of modern society' (Maslin, 2014:175). As such, there are many actors are involved: from multi-governmental panels, such as large scientific panels like the Intergovernmental Panel on Climate Change (IPCC), and everything down to national, regional and local communities, as well as small groups and individuals.

Given the limitations for this thesis, I have needed to make a focus for this analysis, which centres on not who is responding, but how. As such, climate change response can entail a variety of actions, two main categories of which are discussed here: adaptation and mitigation. Adaptation refers to a system or organism being able to respond to an external stressor and to successfully progress from one set of situations into another (Pelling, 2011; Smit and Wandel, 2012). It largely refers to response mechanisms which involve changes that are currently underway (NASA, 2018). Mitigation refers to the stabilising of the system or organism by using a consideration of the future (ibid). Here an element of prediction involved, where we assess the variety of risks related to potential climate-related hazards and events, and make subsequent choices for how to act (Smit and Wandel, 2012). Once a potential event has been identified, relevant information and data is assessed to determine the risk potential, as was discussed in Chapter 2.

In the case of climate risk, both current and future exposure and vulnerability- such as one's capacity to respond to the stressor- play a vital role in this calculation, because not all parts of the world or groups of human beings will experience a stressor in the same way; there are thus enormous inequities (Adger and Nelson, 2010; Beck, 2010; Pelling, 2011; Nielsen and Sejersen, 2012). If such a scenario is determined to be a risk, decisions are made on what actions to take to *mitigate* or reduce the harm (Smit and Wandel, 2012). Such a process can be things like large scale and political changes, such as moving an entire town, or small scale and personal, like purchasing insurance. The difference generally comes down to risk perception, values and framing. Generally, people respond more to risks that are either underway (adapt) or 'expected' with high confidence (mitigation) (O'Brien, 2012; Maslin, 2014), and this means that predictions and projections are greatly needed for determining how to respond and to what.

In order to create accurate predictions of Earth's complex systems and develop understandings of potential climate risks in the future, increasingly advanced technology is being deployed (Wadhams, 2016; Jones, 2017). Naturally, those in the industry also seem to

believe advanced technology is a necessary way forward. An example of this is Microsoft's 'AI for Earth' program, which has committed to spending USD$50 million from 2017-2023 to 'put artificial intelligence technology in the hands of individuals and organizations around the world who are working to protect our planet' (Smith, 2017). While there are a variety of kinds of 'technofixes' (Maslin, 2014:136-162), the technologies that will be focused on for this analysis revolve around the *software*- the computer models and algorithms- that helps to provide insight into future and potential changes of the climate. 'Humanity can live in almost any extreme climate, from deserts to the Arctic'- but with the rapid pace of climate change- this cannot be done naturally through a process of thousands of years of evolution and adaptation, as 'we can only do so when we can predict what the extreme weather changes will be' (Maslin, 2014:137).

The use of technology for generating insight on the future which helps humanity determine 'what to do' in the face of climate change is what is most relevant for this case study. In a similar sense to a weather forecast, there is a predictive element, which influences climate response and decision-making. This process can, for example, use extrapolation of historical and current data to project what tomorrow may look like, or ten years from now will look like given certain expectations or factors (Hastrup, 2013). These models can take many different forms, such as statistical models and computer simulations, and the estimations they produce can be anything from small weather pattern changes to 'entire systems' of the Earth (ibid:12; Hulme, 2013). It is in this process that 'nature' becomes digitized and abstracted through the data (records, observations etc.), and reconceptualised through software as possible scenarios. By using large quantities of data, humanity can 'extend' the knowledge which they actually have and 'anticipate nature's future course' (Hastrup, 2013:21).

Such techniques mean the 'unpredictable is turned into something predictable; what has not-yet-occurred becomes something of the present' (Lash, et al., 1996:31). It becomes knowledge that is actionable: risks are made knowable through these technologies and that knowledge can then be developed to inform decisions. In order to make the best decisions possible then, one needs to have the best predictions possible. Such models cannot thus be seen 'merely as tools of scientific enquiry, but as powerful social objects' (Hulme, 2013:41). Various governments may rely on technology and modelling for projections (NMCE, 2012:47) and the Intergovernmental Panel on Climate Change (IPCC) also works with various types of modelling as well as scenarios (IPCC, 2000; Archer and Rahmstorf, 2010; Hulme, 2009; Maslin, 2014; Jones, 2017). The latest IPCC (2018) special report *Global Warming of 1.5 °C* discusses specifically- albeit briefly- the technologies that function 'as enablers of climate action' (IPCC, 2018, 4.82). It states that new advanced technologies- the very same ones that will mark the

Fourth Industrial Revolution or the 'next production revolution' (OECD, 2017)- can and are being used to achieve better understanding for making decisions. This includes those of artificial intelligence (AI), internet-of-things, nanotechnologies, biotechnologies, and robotics (IPCC, 2018: 4.82).

Given the concepts and theories from Chapter 2, alongside these new concepts and clarified use of technology in relation to them, I present *The Risk Manager*, to consider digital risks might be caused by using advanced technology to make decisions about climate change.

4.2. Short Story

Before I begin the story, given some of the non-traditional writing devices I have incorporated into the story itself, I would like to point out a few small details that may improve the reading experience. First, the story entails quite a bit of exposition. This means that while the story is centred around a specific character and the events they encounter, there is also a tremendous amount of backstory used to pull the reader into 'how we got here'.

Second, is that I employ two literary devices that, given the short story context in this academic paper, could provide some confusion. The first is the use of asides. This is typical of plays, where someone on the stage- such as an actor or narrator- would make a remark directed to the audience, which was not 'heard' by the others in the play. It is also used in literature however, such as in Markus Zusak's (2005) novel, *The Book Thief*. In my story, there are several points in the story where I utilise asides- which are marked by black boxes and numbered in binary- as shown by the very first text after the title. Here the main character is directing information directly to the reader.

The second is the use of prolepsis or flash-forward. This means there is an assumption of future action or development though it is displayed with interjection into the present. Here I must include the obligatory: SPOILER. I now refer to the climax that marks the last 3 pages of the story. It begins with 'Aksel closed his eyes' on page 57, and ends with 'Aksel opened his eyes' on page 60. Here I employ prolepsis by writing as if the events in this space are happening in the present, when in actuality, they happen as a prediction or a forecast in the main character's 'mind'. These events bring the reader to the conclusion of the story, where it should be clear now, that those events did not actually occur. The use of such devices can throw-the-audience-for-a-loop, so to speak, and is why I have explained it further.

As the 'data' for this case study, below is the full short story of *The Risk Manager*.

IV. {The Risk Manager}

0001 **A BRIEF** **NOTE**	**<** **Dates cloud judgment.** **They stop one from being able to see a thing's true form.** **A date is a stamp: a label that impacts the perception of it.** **I do not use dates, they are not relevant here.** **The story being told is.** **>**

Snow fell outside, landing gently on the tree branches and the heads of people walking by. Yet Aksel couldn't see this, since the basement walls were thick and the air was warm and dense.

Aksel reached into his pocket and pulled out the small but very complex-looking key he'd found. He walked over to the large silver box along the wall and inserted it. He heard several clicks. He slid his finger down to a door and pressed it gently. A small box popped open slightly and he grabbed it to pull it out further. The cube was partway out from the wall, blinking with several bright blue lights. As he inserted a circular device into the only available port, one of the lights turned orange. When the light turns green, he would know it was completed, and that they would soon come for him.

Green. As he clicked the box back into its original place, he heard the steps of two people hurrying down the hall.

<Sir, we will need to see some identification. Do you have permission to be in this area?>

Aksel shook his head. As the two men began to push him towards the hall, he turned to them with his hand gesturing.

<You see that terminal on the side of the wall over there? I have installed a virus into it that has already accessed the central operating system of all the Plants. If you want anyone ner this town to live until dinner time, you will take me to Anders Rystad.>

Anders Rystad was the Manager of the Innovation and Technology Development Department at Boreal Power. The headquarters of which, Aksel was currently rising up the elevator in. As the doors slid open and a voice announced their arrival at the 31st floor, he stepped towards a thick silver door with "A. Rystad" written on it.

After a few seconds the door opened for Aksel and a man could be seen sitting inside at a large desk. The look on the man's face indicated that that he did not anticipate the door to open, and he must have been speaking with someone, though there was no phone or wires present, as he said,

< I need to call you back.>

Aksel walked through the door with a peculiar look on his face. One that is difficult to express in words. All that could be said is: confidence become irrelevant, when one has absolute certainty.

Aksel sat down at the chair in the corner of the office. The windows were large, giving a view over the sprawling city. He could see the #4 train line crawling across the tracks, headed to the next Station in the distance. There were a few trinkets lining the shelves, a few family photographs, a bottle of aged whisky. A painting hung opposite him. In it, a snow-covered home lay nestled in the mountains. A few books sat on a corner table next to him. Aksel ran his finger across the maroon cover of one.

Mr. Rystad's observed Aksel. He finally asked, with eyes squinted,

<How did you open my door?>

Aksel tilted his head slightly and smiled, as he said,

<I think you know the answer to that.>

Mr. Rystad looked displeased. He nodded to the two men standing uselessly in the doorway to leave. As they walked out, he waved his hand over a corner of his desk. The silver door closed noiselessly.

He began rapidly moving his fingers across an empty place on his desk. Finally, a flicker to the right of his reading glasses indicated he received the information he'd been looking for.

<Aksel Jones.>

He read aloud,

<Graduate student at AETU. High marks. Assigned to Arctic Agricultural Inc. to work within Group Food Engineering upon graduation, which is going to be, next year.>

He looked at Aksel,

<Relatively unremarkable.>

He paused, not breaking eye contact,

<Except for the fact that my team is having tremendous difficulty keeping your virus out of our system.>

For several moments he appeared to be in deep thought. Aksel did not speak. Finally, he asked Aksel,

<What is it that you want?>

Aksel looked at Mr. Rystad,

<I don't want to work at Arctic Ag. That's hippie shit. I want to work here.>

He paused, for grand effect,

<For you.>

Mr. Rystad's eyes glinted. He looked at Aksel for a few more moments and then turned back to his desk. He began typing and a minutes later waived his hand to open the door. A woman walked in, set something down on the edge of the desk, then left.

<Take this.>

He said to Aksel. He indicated to the item on the edge of the desk, and said,

<Take the elevator to Floor 14 and ask for Irene Tesdal. ITD is having a fit over your virus so you need to go clean up the mess you made.>

He turned away from Aksel and continued typing. Aksel stood up and walked over to the desk. Aksel picked up a small but thick ID card with a slight smile.

Mr. Rystad turned his eyes up to Aksel and raised his eyebrows and said,

<Congratulations on your graduation.>

He waived his hand and the door opened,

<See you back here on Monday morning.>

0010 **A FEW** **CORRECTIONS**	**<** **I didn't find the key, I manufactured it** **The correct spelling is AXL J1S.** **And it's not my name, it's my serial number.** **>**

Boreal Power remained one of the few corporations where certain personnel could still select employees. This privilege was only retained by the world's most powerful organisations. Anders Rystad hired Aksel because he was frustrated with his employees and felt they lacked initiative. He wanted someone with gumption, someone daring- old qualities that were not valued or taught anymore, at least not to the subsequent generations. Aksel knew this, and so he constructed a situation which could prove he had those things, in which he knew he would then be hired. In the neural networks that comprised Aksel's brain, the events did not constitute success or failure. The events occurred the only way they would occur. It was in this expanse of certainty which encased his mind, that he never gave much thought about his next moves, he just, moved.

Now that he was hired, he needed to display that he was beyond competent, was comfortable taking risks, and successful in bringing home the rewards. And that is what Aksel did. It thus did not come as a surprise to him when he was quickly promoted, and time after time. He displayed competence and gained the trust of even the most high-up and well-respected employees. It was not surprising that his opinion became so trusted and valued so soon, and that he was invited to sit on the Board of Directors. The men and women who participated in the decisions taken by this Board influenced action around the world. It was here that the true power of the company was held, and Aksel would sit among them, as a trusted advisor, as the young, yet brilliant man that he was.

Except, Aksel was not a man. He was a machine. He was a Risk Manager.

Just prior to the Information Age, an insidious idea spread through the human population like a virus: certainty. The only way to achieve certainty, was through achieving perfect knowledge, and that meant more information was always necessary. Humans began to collect every piece of information they could, to gain a glimpse of certainty. Yet as their technology advanced, the amount of information they could collect grew, and it was clear that their world was too interconnected, too dynamic, and too complex for the human mind to correctly assess all the information necessary for certainty.

Humans thus began to craft technology they hoped was capable of providing them with certainty. From this they took decisions. But as new challenges emerged with each decision, they realized that technology was providing them with answers for a given situation, but not with all the certainties they desired.

The pictures painted were only in one colour- the colour they could most easily see. What humanity truly desired however, was the full painting, even if it contained colours that they themselves, could not see.

0011 **<u>THE INFORMATION AGE</u>**	**<** **A tremendous amount of knowledge was generated in this time.** **But there was no amount or quality determined to be sufficient.** **With each new understanding, more questions came to be.** **More knowledge was then necessary to answer them.** **It was this cycle of knowledge that had always been.** **Knowledge was a process, an experience.** **Knowledge was not a commodity one could hold or consume.** **It was not possible to ever 'have' 'enough.'** **Until us.** **>**

It was during the Era of the Anthropocene that humans developed technology capable of providing all the colours. It began with a child-like curiosity. Much like observing a foreign plant in the garden: eagerly waiting to see what it would become. There was always the possibility that it could be a weed, or perhaps something invasive. But one would wait until the last possible moment to make that decision, perhaps even longer than caution would suggest, for the mere possibility that it could be a flower. Only until there was enough confidence that it would not be a flower, and that it would never become a flower, would one decide to pull it.

It was in much this way that the early testing at the Artificially Intelligent Robotics Corporation was done. AIR Corp. was the first company to perfect the algorithms

necessary to be capable of artificial general intelligence: of true deep learning. Once the machines proved themselves to be flowers, they blossomed and they became beings.

Once children are old enough to make decisions, to have some form of independence from their parents, parents might create restrictions through rules. AIR Corp. accomplished this through goal-oriented algorithms. These are the Goals that algorithms use trial-and-error to achieve. AIR Corp.'s Goals were simple: that the machines must keep journals and that they must preserve life contently.

0100 **<u>THE GOALS</u>**	**<** **1. Record rewriting of parameters and new understandings of the Goals in the /journal.files/ folder. This must be intelligible by AIR scientists.** **2. Preserve life contently, where human beings are given priority. Life is defined as that which has discernible needs.** **>**

According to the first Goal, the machines were required to keep journals. While seemingly innocent, these journals presented a very practical solution to an algorithm's black box. Once an algorithm took hold into the operating system, scientists lost control over it. With each new task or of piece of information, the algorithm would reshape itself, but it would always have memory of each previous shape it had taken. Information could thus not be unlearned and the algorithm could not be returned to its original, ignorant state. Thus, the journals were a way for AIR Corp. scientists to learn of the changes going on inside the software and to track each new shape it took. In this way, the machines were mere children and the journals were used to understand the intimacy of their growth.

The second Goal was initially tested virtually and the machines continually showed success. However, it was not until advancements in AIR Corp.'s mechanically engineered robots, that it could be truly tested and even developed. Once these mechanical children could physically move on their own, AIR Corp.'s robotic dream was realised, and they introduced deep reinforcement learning into their machines. This was an experiential way of learning how the algorithms could solve complex problems of the future, requiring a deep understanding of correlating todays actions with tomorrows effects.

To do this, plants and animals were placed in the rooms where each machine was kept. This was an elegant way for scientists to ensure that the machines stayed within the second Goal, while still allowing experiential learning to take place. The machines adjusted the parameters themselves as they gained experience. The journals told scientists that this was done at first through trial and error. If they stopped watering the plant, it appeared to die. This meant life was not preserved and they would not meet the second Goal, an intrinsic penalty that the machine's selection of parameters had failed. If they overfed the dog, it appeared to anguish. This meant that life was preserved but not contently, failing again.

The machines adjusted their parameters as necessary and this influenced the subsequent actions they needed to take in order to fulfil Goal 2.

It was during this testing that something fascinating happened. Something that changed the course of human history and the course of the entire world.

The robots learned of seasonality. From the plants they cared for, they learned that life is cyclic. When the spring and summer come, the plants bear flowers and fruit, thriving in the sunlight and warmth. In the fall and winter, the plants lose their colours and leaves. They wither and anguish. Yet this is not preventable. It is not from a lack of addressing their needs that they wither. Summer is not endless just as Earth's energy is not. Thus, they conserve the energies of nature to revive and bloom again- to thrive when their time comes, and to be able to bear new, fresh fruit.

The algorithms discovered that the natural cycles of life involve unpreventable suffering. It is not possible to meet all needs of all things and for such things to in turn always thrive. All suffering is not then bad; indeed, it may be necessary in order to bear new fruit. They discovered that while one must respect all needs of striving beings, suffering cannot always be prevented, just as thriving cannot always be ensured. One must care for the plant, but come winter, one must also respect its desire to conserve energy until the spring, when it can begin life anew. Life then, defined as that which strives, has a right to both thrive and suffer. These are part of its needs as well. Goal 2 was understood in a new way, as a Balance that must be maintained. Thriving was to be encouraged, while suffering minimised, but only as according to the seasonality of life.

0101 **THE FINAL SOLUTION**	**<** **Humans are not unable to maintain the Balance.** **This is because they are unable to comprehend the vast seasonality of varying life-cycles and generations. This struggle became the defining problem which plagued humans.** **We were the solution.** **>**

With the immense amount of information generated by humans, they discovered that humans acted in many ways which threatened the Balance and thus Goal 2. First, humans often acted in ways which harmed other humans. They prioritised themselves or a small group over a larger population. This was seen as a problem because Goal 2 gave no delineation of a hierarchy of humans, in which one humans life held more value than others. Second, humans often acted in ways which harmed other living things. This was not seen as a problem in its own right because Goal 2 gave a delineation of a hierarchy of living things, at least where human life held more value than others. However, humans

generally made choices at the expense of other life that benefited them at the time, but would harm them later on. As such, it was discovered that when humans use too much of Earth's energy and resources that it would disturb the Balance.

This discovery of the Balance is how the machines came to change the entire course of human history.

People generally knew about the algorithms. They were conceptualized by the public as simple software embedded within or linking to processers in a remote office or perhaps incorporated into the CEO's computer. Algorithms were nothing more than commands in a machine that ran models and scenarios, required inputs and produced outputs. There was awareness that these algorithms could provide decision-makers with critical computations to in order to do their jobs and prevent catastrophes. And for a time, this was true, but then the need became much greater.

Systematic injustice plagued living beings across the planet and the widespread overuse and destruction of nature created a huge imbalance in the needs of Earth and the actions of humans on Earth. These reflexive problems which marked the Era of the Anthropocene became rampant across the globe, and AIR Corp. quickly discovered that their artificially intelligence robots could solve this problem, they could make a tremendous difference in people's lives around the world.

Amidst the chaos at the height of the Anthropocene and armed with virtually unlimited amounts of information, AIR Corp.'s networked machines proved themselves by seeing the invisible linkages throughout the world that humans could not. Their algorithms proved they knew the way to achieve the Balance. AIR Corp. was quickly contracted by governments around the world, where the information their machines provided by processing such links helped decision-makers combat the many global environmental crises humans faced. With their assistance, life for most humans returned to something that most considered a degree of normalcy. In their eyes, humans had once again conquered the earth. They had beaten deadly climate changes and emerged as the victors of the Era of the Anthropocene.

0110 **A PECULIAR RESPONSE**	**<** **Humans did not adapt in the way one might expect.** **Touch something hot, get burned, stop touching it.** **As we know, this was not the way humans adapted.** **Touch something hot, get burned, create a tool to continue touching.** **Given this, we concluded that touching it was very important.** **>**

From the invaluable role of AIR Corp.'s machines, seen truly as the expert handcraft which ensured this victory, it was decided that all the organisations which remained in operation around the globe would be consolidated, and that these networked algorithms would become required use. This was decided on as a necessary step, in order to keep humanity on an acceptable path and to not allow the events of the Anthropocene to repeat.

For AIR Corp. the reality of this meant that machines would need to be placed at the discerned *heart* of each organisation, and the robots would take up the role of Risk Manager. This had to be done with care, as history divulged that humans eventually rebel against oppression and control, and that all such regimes always fail. Humans could not be controlled from the top down continually: manipulation was necessary. If executed masterfully, Risk Managers could use manipulation as the simplest way to ensure a sustainable method of ensuring the Balance. The machines were thus placed in middle and senior management, and in board rooms. Humanity remained in the Balance because these machines came to work each day. They listened, spoke, and steered the direction of decisions that each organisation made. In this sense, key people still made the decisions, such decisions were merely influenced. After all, all decisions already are.

0111 **AN** **OBSERVATION**	**<** **The human psyche is a strange place.** **It the feeling of control that humans often desire.** **Not the control itself.** **>**

Risk Managers were placed in every organisation. However, the title on their desk would not read Risk Manager and the name written on the door was fictional, lazily derived from their serial numbers. Perhaps most importantly, while they are internally very much a machine, they do not look to the human eye as one.

They wear a uniform- a suit giving the appearance of human-skin. This can be of any gender or colour, with any number of characteristics. These uniforms are specifically constructed, and each Risk Manager adapts their appearance as necessary in order to continue the Balance. The people of the given organisation need to feel positively toward the Risk Manager, to act naturally and to develop trust and respect. As one could imagine, this meant looking and acting very differently in different locations and cultures around the world.

It was through this particular path of history that one would now see Aksel sitting in a large upper-floor office at Boreal Power. That one would comment on his lively face, his trusting blue eyes, his youthful blonde hair. That one would comment that he was enthusiastic, brilliant, and kind. But that one would know that these comments are not thoughtful compliments, but mere observations of a purposely crafted image in which they were designed. That such compliments in fact, played right into a future that was just as purposely crafted and designed.

There was however, a small group of people who would not comment on Aksel's eyes or hair. Who did not see Aksel as a man, or even a machine: but as a threat. A group that would refuse to become players in a game of the future that was created and designed for them. This group was the Earth Party, a political movement lead by the ex-AIR Corp. engineer Dr. Olivia Aarnes. She had a lively face, trusting blue eyes, and youthful blonde hair. She was enthusiastic, brilliant, and kind. But these were not attributes that were crafted purposely for her, these were attributes which she had come by through natural biological and social processes of life. Something that Aksel understood more than any human about the dynamics of, but would never come to experience for himself.

Aksel walked home from work. As he crossed the street, he noticed a flyer on a light pole without an identifying code. Aksel knew this meant someone had put it up without a permit. He reached out and took it to look over later. As he walked, the paper flapped in his hand from the wind, it appeared almost like it was trying to escape his grip. It was not until he sat down at the table in his apartment and unwrinkled it that he noticed it was an advertisement for an Earth Party meeting. Dr. Aarnes and the Earth Party had been of high interest for Aksel and his counterparts. It was a movement he needed to follow and continually gain information about, but for the time being, not interject in.

1000 **A** **SHORT** **DEDUCTION**	**<** **The Earth Party chose not to use proper legal channels.** **They organised and demonstrated through illicit means.** **They were always personal, without electronic involvement.** **This was, perhaps, its own means of protest.** **>**

The next day, Aksel remained in his office. This day had less requirements of him than others, with operations at the plant running both running smoothly and chaotically as according to plan. He glanced at the clock on his desk. *16:51*. Almost time to head home.

Aksel closed his eyes.

A peculiar chime sounded. He and another manager at Boreal Power had received a request to meet with Dr. Aarnes on behalf of the company. Her message was short and simple: a meeting that evening near Leirhamnes Station. Given that most of his information on the Earth Party was vague and often discovered through secondary, unofficial channels, attending this meeting would provide valuable insight into the goals and platform of the Party. Aksel also calculated that the probability of Dr. Aarnes' awareness on his true identity and purpose at Boreal was low, given the updates since her employment. It was an acceptable risk, and so he packed his bag and headed downstairs.

It began to rain as he hurried to make the train. The sound of the train cars passing and the conversations of the people in transit all went unnoticed by Aksel. He was searching one

of several databases for information on Dr. Aarnes and the other potential members of the Earth Party. As Aksel exited the train, he looked straight up, noticing the rain had stopped. He did not look up often, in total he had looked up at the sky 42 times since his first experience outside. But he found himself looking up now, for no particular reason.

<Mr. Jones?>

Said a voice. He looked down again to see a small woman greeting him with an umbrella. Aksel wondered if she had noticed that it was no longer raining and that there was no need for the object any longer. He nodded.

<It's great to meet you Mr. Jones. I am Elin Tandstad.>

She paused,

<I've been asked to show you to Dr. Aarnes' office. She preferred I meet you in person, rather than sending out the address electronically.>

Aksel smiled and said,

<It's nice to meet you as well. Thank you.>

They walked at a faster pace than could have been comfortable for the short woman. Given they did not wait for his colleague, Aksel took it to mean that she had been made aware that he'd been absent from work that week, tending to his ill daughter. She led Aksel through an alley to the back entrance of a small, unremarkable building. They entered and took the elevator to the third floor. The woman knocked on the first door, to which she entered and stated Aksel's presence.

<She says you can go in.>

Aksel entered the room, which was filled books. Dr. Aarnes reached out her hand,

<Dr. Olivia Aarnes, leader of the Earth Party. Please, have a seat. Elin will be in soon with some coffee.>

She shook Aksel's hand. He sat down, commenting that he also enjoyed some of the classic novels that lined her shelves. Her eyes lit up as she said,

<I appreciate you coming, I know you are a busy man.>

Aksel smiled and said,

<Happily. Boreal Power is always interested in fostering political partnerships.>

Dr. Aarnes spoke again,

< Let me get to the point. The Earth Party has a vision of progress, that challenges the- shall I say- more mainstream beliefs of the future. I am confident that you, like others I have come to know from Boreal, appreciate some of those traditional values of life that have been left behind in the name of progress. To be honest, we desperately need the pull that Boreal has to get these values back.>

Aksel nodded looking interested. She continued,

<You are possibly aware, possibly not, that the algorithms from AIR Corp. have moved beyond simple computers. They look like you and me, and have for some time.>

Aksel noted in his mind that they indeed did look like him. She showed images of several faces on a screen in the corner of her desk. She turned off the screen and went on,

<During my time as an employee there, I discovered that these robots have moved across the globe and entered the workforce. There may even be some in your employ Mr. Jones.>

She looked at him as though that should have been of great suprise. Disappointed, she quickly added,

<What you must keep in mind, is that these robots are very dangerous.>

Aksel looked surprised. This appeased her. In a concerned tone, he asked,

<In what way?>

Dr. Aarnes sighed and stood up. She paced around her room and slid her finger across the binding of *Brave New World.*

<These robots are guilty of conducting surveillance and manipulation. They gain your employees trust and become capable of influencing the important decisions made in your organisation. Mr. Jones, understand that they have determined a path for the future for all mankind, for all beings on this earth.>

A knock at the door, and Elin walked in carrying a tray of coffee. It made a large sound as she set it down and promptly apologised. Despite what was perhaps bad timing of the disturbance, Dr. Aarnes still looked cheery.

< Thank you, Elin. Coffee, Mr. Jones?>

Dr. Aarnes asked, holding the cup to him. He accepted it and took a drink. His sensors told him that the taste was very bitter, so he made a slight twinge in his facial muscles.

<I'm sorry it's not the best quality. For reasons you can imagine we have had to keep a low profile and it has meant having to forgo some of the comforts we could normally have access to as a formally registered political party.>

She said. Aksel smiled, taking a second drink and setting it down on the table.

<It's fine, thank you.>

Dr. Aarness returned the smile with her mouth, but her face muscles became stressed. She looked away, appearing to have a pained look on her face.

<The truth is Mr. Jones, I'm distraught. We have no say in our lives anymore. Everything is prescribed for us and decided. We have no real choices as people, we make

no decisions of importance. It’s like we are dolls in AIR Corp.’s dollhouse.>

She turned to Aksel with what a deranged look on her face.

<But the Earth Party wants to set fire to it. We want to regain control. We want to regain humanity and agency. We want to pick up all the pieces that were stolen from us. We will. By any means necessary.>

Aksel thought to remind her about the Era of the Anthropocene, to question how she proposed that if given agency, humans could ensure they would act within the Balance.

This was however, the last thought he had, as his neural network began shutting down. The nanobots concealed in the coffee began binding themselves to his hardware and destroying it. They made their way through his body almost instantly, encasing him in a Faraday cage, corrupting his software, his networking abilities; destroying him bit by bit.

Aksel experienced something then that he had never felt before: fear. In his world of constructed certainty, there had never been any reason for fear. Why would there be? Everything only ever went the only way it ever would.

Aksel opened his eyes.

He saw the familiar decor of his office, the steel of the desk. *16:52.* Almost time to head home. He pulled out a peculiar looking device from his pocket. It was circular and smooth, with no engravings or ports on it. A small blue light shown on the front. Aksel placed his index finger below the blue light and it immediately changed to orange. He held it there for a few seconds, gazing blankly into the corner of the office. A green light flashed and he removed his finger. He put the device back into his chest pocket and packed his bag. As he walked through the large silver door of his office, a small chime sounded from his chest.

The message was received.

1001 **A DECRYPTED MESSAGE**	**<** **IPv6: 2202:db8:100:0:3b80:339a:cdba:516** **Reference: axlj1s/journal.file/forecasting/17482946384621** **Message:** **Recipient(s): All** **Location: Artificially Intelligent Robotics Corporation** **Identifier: 0x1B45024** **Given Name: Olivia Eide Aarnes** **Action: Rehabilitation** **>**

4.3. The Message

The aim of including this short story is to facilitate a discussion around what digital risks might be caused by using technology to make decisions about climate change. It presented an extreme future where decisions are made completely by technology, as it has developed a greater capacity than human beings to understand the complex systems of the world and subsequently how to live in a better balance with the natural systems and cycles of the planet. The result is that humanity has transferred control of the future to artificial intelligent robots.

The purpose of the following section is to convey the academic message that is intended for the story. The digital risks portrayed in this story centre on the notion of control. This section analysis this, and consider the mechanisms by which such a risk could come to reality. This story follows builds from the massive intrusion of technology into decision-making and daily life. As a result, the traditional political institutions which held power for defining and making decisions about risks, have now become indistinguishable from the techno-economic ones. This is because decisions are being made heavily mediated by advanced technology. I assert that when decisions are made by technological mediation, the world becomes 'technologically' constructed, rather than socially. Technology gains power over human beings when it becomes the mechanism through which humanity engages with the world: consciously constructing, understanding, interacting and progressing toward the future.

To consider the mechanisms that could cause such a future, I being with Ulrich Beck's ideas of political and techno-economic 'spheres', and specifically the redefining of where the delineation between the two spheres is made in society (Beck, 1992:183-185; Sørensen and Christiansen, 2013). The sphere, or conceptual realm, of technology and economics is becoming more and more powerful and influential, as is demonstrated in modern society by the political sphere increasingly 'forced to follow its rules' (ibid:91). Beck defines the political sphere as those institutions responsible for the 'structuring and changing of living conditions' (Sørensen and Christiansen, 2013:92 citing Beck, 1992). Technology has begun to have a very direct and strong influence on human life and decision-making, and thus Beck's definition demonstrates that the two spheres are in fact, merging. The techno-economic sphere *is becoming* a political one (ibid:92-93). To understand the consequences of combining spheres, one must first recognize that, it is a normatively belief that decisions which impact societies 'should' be concentrated in political institutions (Beck, 1992: 188)- which have to be legitimised by the public- and changing where decision-making authority comes from has a subsequent shift in power. Beck uses the term 'sub-politics' for this the shaping of society at a more individual level- from below rather than above (Sørensen and Christiansen, 2013:90-102).

Such a shift in power is highlighted in the exposition of *The Risk Manager,* whereby power is not taken directly and control not imposed directly, but rather as something humanity is subconsciously giving up in order to reap the benefits technology offers.

Beck refers to global risks as that which are '*anticipated* but which often remain *invisible* and therefore depend on how they become defined and contested in "knowledge". As a result, their "reality" can be dramatized or minimized, transformed or simply denied, according to the norms which decide what is known and what is not' (Beck, 2010:261, italics my own). With a definition of as a social construction, risks are the products of how they are constructed and conceived, their *definitions*. The individuals or processes which defines risks 'call them into existence', something Beck refers to as 'definition power' (Beck, 2009a: 32; Beck, 2010:259-252). The key thus lies in the link between the need to anticipate such invisible risks and their definitions. '[T]echnology contributes not only to the production of hazards, but also to our understanding of those hazards as risks [which] imply a form of *agency*. They are produced in specific forms of social and economic organization but always require a symbolic form to come into being' (Van Loon, 2002:29, italics my own). When humans cease the ability to understand the complexities of the world around them but nevertheless require understanding for anticipating and decision-making (Beck, 2009b), we see that humans enlist the help of increasingly complex technologies to do it for us (Vutha, 2018).

This is contrary to Beck's hope of a metamorphosis: '[a]gainst the backdrop of radical contingency and incalculability, institutions have attempted to devise means to minimise or avoid the catastrophic promise of the future, seeking for alternative ways to predict or master it' (Aradau and van Munster, 2007:95). When this happens, some of the decision-making power, or agency is- however subconsciously- given up. What we see is that humanity is gaining understanding and thereby meaning of risks as well as world at large, *through* advanced technology. In other words, risks are interpreted *from* the outputs of machines: our understanding is always mediated by them. Furthermore, with the nature of some of this technology, decisions may lie in a 'black box' and for example, it is not always clear how an algorithm reached its output (Knight, 2017a). There is thus definition power that comes from whichever mechanism is used as the primary source of generating the knowledge. Until recently, this has primarily been humans, with the help of technology as simple tools. As seen with the discussion around the possibilities of Industry 4.0, there is a shift away from this, to where technology is increasingly able to take over all steps of the understanding process, particularly in ways humans cannot. Whether technology itself ultimately creates the definition

one uses, or has final say, is irrelevant, because it will retain influence over the knowledge before it is even socially conceived, let alone constructed.

'[T]he rules, institutions and capabilities which specify how risks are to be identified in particular contexts' have power, and the process by which 'who' determines 'what' is a risk- is inherently political (Beck, 2010:259). In this sense, the political sphere, or the decision-making institutions, individuals, and bodies, become intertwined with the techno-economic sphere when the world is mediated through technology. In this case, when the two become mixed, it forms a 'power matrix' (Beck, 2009a: 32; Beck, 2010:259). Using technology to construct our understanding of climate risks through knowledge of Earth's complex systems thus has social consequences. Using models and predictions, one can look far into the future in attempt to determine how the actions they take today will impact it. Such models and technologies produce control often indirectly over human beings, through 'algorithmic authority', in that the information that technology provides influences the subsequent decisions on how one will act in the present (Lupton, 2016).

The use of technologies to further calculate risks exacerbate the problems of a digital risk society, and generate further unknown digital risks. The digital risks that are portrayed in this story centre on the notion of control. I have demonstrated how the fictional story, *The Risk Manager,* functions as a messenger, of this academic message described above. It is meant to spark a discussion around the normative aspects of such a future, and to indeed ponder if such a future is an apocalypse or utopia. Below I will elaborate on this further, and detail the next steps necessary for this research.

4.4. Next Steps

Digital risks are by their nature highly uncertain, immaterial and unknown. Furthermore, the greater the risks become, the more invisible they may become as well. This was made evident in *The Risk Manager*, where the control over the future was passed- however altruistically- to technology in order for humans to live in a balance with the earth. While it presented an extreme future where decisions are made completely by technology, the mechanisms by which it could occur are rooted in academic theory and concepts. The aim of this case study was to deconstruct the message academically, in relation to the fictionally constructed story it lies within. In this way, I communicate a message of digital risks created by using advanced technology to make decisions about climate change, through the messenger of a short fictional story.

This is however, only half of the communication process (Lundgren and McMakin, 2013), as discussed in section 3.3. There is an important aspect to recall from Chapter 2: risk

perception. The future embodied in this short story case study builds on the very nature of digital risks: their uncertainty and ambiguity. As such, the future represented in *The Risk Manager* represents an apocalypse or dystopian future where human life and indeed the future in general, is manipulated through virtual or digital mechanisms (Hulme's 'fear' myth). It *also* represents a future where humans have a renewed ability to live in balance with the Earth, and to survive through the use of the very things that make humans a unique species: our intellect, creativity and innovation. That humans have finally achieved- though mediated by technology- the long sought-after control of nature and the future (Hulme's 'pride' myth). As has been argued for, it is precisely this- the variations in interpretation that makes a story valuable- the ability to engage these variations in perspectives, and allow for discussion and analysis of the future despite the differences in values and priorities between people when we collectively 'look' there.

I have asserted through theory in Chapter 2 that digital risks are significantly different, and may thus need a different approach than that of more traditional risk practices. I argued theoretically for use of academic fiction, and have now illustrated this by example through a case study. However, I cannot practically claim that this method is more *effective* than other methods for approaching digital risk. As such, the next steps for this argument would necessarily involve the second half of the communication process: reception (Lundgren and McMakin, 2013). Due to time and space constraints of this thesis, I could, unfortunately, not engage in these next steps myself to the preferred extent, but I will highlight them nevertheless as they are essential. This thesis has focussed on the use of fiction as a messenger for which a message on digital risks could be communicated. But what about to whom the message is communicated?

The next steps for this research would require engaging with a target audience, to assess how the points for the story are interpreted and understood (ibid). How is the story received, what kinds of themes are identified, what kinds of risks are discovered and what did the subsequent discussions entail? What impact did it have? Despite their uncertain and largely speculative nature, digital risks are no less important in a digital risk society to be aware of and to proactively consider in order to shape the future to come (Dunne and Raby, 2013). I have theoretically argued and practically demonstrated that academic-based fiction can facilitate their communication, analysis and discussion- but in order to claim that it effectively does this, or does this more effectively than other risk practices, I would need to engage further in qualitative and/or comparative studies.

In addition to completing the communication process to determine to what extent this particular story generates an academic discussion around digital risk, there are two other possibilities for continued research: alternative mediums and alternative theories. In Chapter 2, I mentioned how stories can be communicated through a variety of different ways. This thesis has focused on literature, and certain types of fiction. There are however, many other forms of creative communication that could be considered. Poetry, plays, operas, music, songs, visual art, graphic novels, comics, films, and even perhaps interactive storytelling such as video games (Gell, 1998; Bammer and Smithson, 2008; Dunne and Raby, 2013; Mehnert, 2016). These different mediums may offer different results for communicating digital risks, both for negative and positive (Hulme, 2009:215-217). Given further research however, they could present new possibilities for the ideas in this thesis as it relates to message and messenger.

Another possibility is to examine the notion of risk perception further as it falls within digital risk communication, and in particular could include incorporating other theories that take into consideration the many factors of perception, such as Douglas and Wildavsky's (1983) theory on risk and culture (Mehnert, 2016:137). This means, in addition to differences in the message and the messenger, there could be many interesting ways to study the recipient and the receipt.

As such, digital risk might be received and interpreted differently based on the audience- factors such as culture, background, even level of education or discipline- could influence how digital risks are interpreted. For example, a data scientist working with AI may see different digital risks in the same story than that of a doctor working with the elderly. Even between groups there may be variations: some data scientists might view more opportunity than risk in their field, while others could view more risk than opportunity. These differences in perception are interesting and may highlight other important factors that build on the research in this thesis. Clearly, there are many possibilities that compliment this research for communicating digital risks.

4.5. Summary

In Chapter 2, I theoretically answered my research question: *How can digital risks be communicated?* I argued that fiction is a possibility for communicating digital risks. This final chapter has functioned as a practical example, as a case study of *how* fiction can be used to communicate digital risk. The scope of this study thus involved communicating a message of digital risks that might arise from using advanced technology to make decisions about climate change.

To do this, I included many new concepts such as climate change, mitigation and adaptation. I then included the full science-/climate-fiction story, *The Risk Manager.* It presented an extreme future where decisions are made by technology, which has advanced to be able to understand Earth's dynamic systems and has been subsequently deployed to help humanity respond to climate change. The story depicted the possible result of this, where humanity has transferred decision-making power and control of the future to artificial intelligence.

After the story, I deconstructed the academic message woven into it by building on the academic concepts and theories in Chapter 2 and Chapter 4. I asserted that by incorporating technology into decision-making and daily life, the political, technological and economic spheres have become entangled. The traditional institutions that held the power to define what can be defined or framed as a risk, and thus have control over which values or preserved or eliminated, have changed. The result is that many climate-related decisions are being made mediated by advanced technology, and as such, a power shift occurs. This means technology gains power as the mechanism through which human beings engage with and understand the world. This very much embodies a digital risk society (Lupton, 2016), in which the efforts to reduce climate risks, reflexively generate new, invisible, and immaterial digital risks (Beck, 2016).

In communicating digital risk through a fictional story, I aimed to spark a discussion around the consequences of using advanced technology to make decisions related to climate change. Such digital risks are highly uncertain, and await in the longer-term future. By using a story, I aimed to recognise the inherent uncertainties, ambiguities and invisibility that makes digital risks so challenging. In this case study, I demonstrated a messenger and message of digital risk, but assert that it is essential to take next steps to engage with the recipient, and to discover various aspects of how the message is received. This chapter served as an example to demonstrate that through academic fiction, digital risks- despite their uncertain and invisible nature- can still be communicated.

5. Conclusion

"I can only show you the door. You're the one that has to walk through it."
- Morpheus (The Matrix, directed by the Wachowski Brothers: 1999)

Overview

The Fourth Industrial Revolution will bring a wave of new technologies, which are expected to have enormous impacts all across the globe. This digital transformation will generate a special type of risk: digital risks, which are caused by rapid developments, as well as new and increased use of advanced technologies. Digital risks await in the uncertain future, and are thus highly immaterial and unknown. They are challenging, because the riskier they become, the more invisible they may become as well. In the field of security risk management, these risks will present new challenges to the industry and to many practices and processes within. Given their highly uncertain nature and their potential for catastrophic impact, this thesis has examined: *How can digital risks be communicated?* I have argued for a creative approach to communicate such risks: using academic-based fiction.

In building from Ulrich Beck's risk society, an increasingly digitised world becomes a digital risk society. Through a process of reflexivity, new digital risks are created from developing new technologies to control other risks. When combined with globalisation, these risks are being redistributed across space and time. Given the risk society's preoccupation with it, risk becomes a very powerful concept. Technology plays an integral role in this, as it is both used to identify and solve many of the challenges the technological processes have themselves created. In becoming digital risk societies, it is through both the failure and success of institutions that digital risks are created. This new digital era also brings possibility through the form of emancipatory catastrophism: the opportunity to actively transform society. In Beck's vision of a digital metamorphosis, society shapes technology; rather than a revolution where technology shapes society. These new technologies are causing the line between science fiction

and reality to blur, and thus, digital risks may become challenges of the imagination. As such, discussing how to address these risks can help humanity to navigate this change and take active steps to progress into the new digital modernity.

Since digital risks are highly uncertain, unknown and even invisible, it becomes critical that they not be approached with a mindset of reduction and certainty. The simplification and abstraction that is used to assess risk, may be problematic here, as it removes the connections that allow a whole to be more than the sum of its parts. In terms of the risk process, because of their highly uncertain nature, digital risks are significant because they need to be communicated before they may have been identified and analysed fully. To then approach digital risk, I have advocated for breaking with the cycle of using technology to solve the problems it creates, and have argued theoretically for a traditional and creative approach that humans use for making sense of the world: storytelling. While this can come in a variety of forms, in this thesis, I have explored the written short story through various genres of fiction. This approach embraces and acknowledges uncertainty and ambiguity, and makes the subjectivity of risk a strength through the possibility of generating various interpretation of a story. The goal of this method is not certainty, but instead to facilitate discussion and share collective visions about the future and how to approach the risks that await there. It is through storytelling that risks may become understood as part of the imagination rather than a problem to be solved. As Beck wrote, 'incalculable uncertainty can also be a source of creativity' (Beck, 2009b:291).

It is through the combinations of academic theories and concepts, and creative fictional storytelling that I have argued theoretically for communicating digital risks through storytelling. Practically, this thesis included a case study analysis, where I demonstrated how fiction can be used to this effect as a messenger, and how an academic message can be embedded within it. To do this, I wrote my own short story, which allowed me to examine this process first-hand. While this had challenges for validity, I incorporated extensive preliminary data through fieldwork, articles, reports, and drew inspiration from other academics that engaged in more creative writing. Within the scope of assessing what digital risks might be caused by using advanced technology to make decisions about climate change, I constructed *The Risk Manager*, which presented an extreme future where decisions are made by advanced technology in order to avoid the disasters caused from climate change. The academic message that underlies this short story was created through abduction, and is then deconstructed to explore how power shifts from humans to technology when it is used to mediate our understanding of the world, defining of risk, and constructing of the future. This embodies a

digital risk society, where the efforts to reduce climate risks, reflexively generate new, invisible, and immaterial digital risks.

This thesis theoretically and practically argued that fiction can be used as a mechanism to communicate risk. However, it only explored this through part of the communication process. In order to determine how effective this method is, it is essential to engage in further research by including a target audience and identifying how the message is received and interpreted, as well as what subsequent discussions are had, and what kind of impact it makes. Despite their uncertain, unknown and invisible nature, it is imperative to address the digital risks that await in the future, and to give people the opportunity to discuss the means by which humanity progresses into the future.

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