Science and Society: behind the scenes

Exploring the science-society dynamic in Longyearbyen, Svalbard

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1. Introduction

Philosopher Ludwig Wittgenstein asked his friend once: “Tell me, why do people always say it was natural for men to assume that the sun went around the Earth, rather than that the Earth was rotating?” His friend replied:” Well, obviously, because it just looks as though the sun is going around the earth.” Wittgenstein said:”Well, what would it have looked like if it had looked as though the Earth is rotating?!”[1]

1.1 The topic

Science has long enjoyed a reputation of authoritative and trustworthy enterprise. Science workers were seen as noble disciples of this truth-producing pursuit with an ultimate ambition to increase the social well-being. In recent decades however, this reputation and trust in science and scientists have begun to wane, and the relationship between science and society is beginning to transform.

The driving force behind this thesis is indications that the relationship between scientific community and the rest of society is strained. There is an apparent disconnection between the two, as well as the general societal consensus that for the mutual benefit of both communities, this detachment needs to be bridged. Thus, I commenced a search for the roots of this crisis, through identifying the barriers that stand in the way of improving the relation between science and society. The assumption of this thesis is that changes in the way that science is conveyed, perceived, understood and ultimately materialized in society can result in this relation being reformed.

[1] Richard Dawkins at TED Conference

Therefore, I focus on discovering the obstacles to improvement of this relationship – from more articulated scientific knowledge disclosure, an increase in public interest and understanding of this knowledge, to the socio-political background that this relation is set against. In this thesis, I at times use the phrase *science communication* to delineate the dynamic between scientific *milieu* and the rest of the society, i.e. the interaction that is concerned with and has a purpose of mediating scientific knowledge.

Considering the colossal proportions of science and the broadness of the term 'society', I focus on a particular scientific domain in a defined space - environmental science[2], in the community of Longyearbyen, Svalbard, using it as something of a paradigm for all of science in the global society.

1.2 Rationale and research objectives

The dynamics between the scientific community and the wider public has become essential to our lives. Scientific literacy is seen as having a potential for being an agent of individual and societal empowerment, by providing equipment for making sounder and more informed decisions that are less dependent on random choices or dogmatic knowledge. Incomprehensible or undisclosed scientific knowledge, as well as the style of science-based decision making and implementations may create confusions, give rise to misinterpretations and an opportunity or a perception of a monopoly and misuse of science, resulting in resent and detachment from scientific community and knowledge altogether.

[2] Environmental science is still a broad spectrum of disciplines, in this thesis I focus mostly on climate change, pollution and nature management. However, at times my informants talk about natural science in general, and referring to the environmental science in situations when it is of relevance. I do not refer any of the uses of the word 'science' and 'knowledge' to any sciences other than natural ones.

In the case of environmental science, there is a capacity and a need to expand science-society interaction into a new domain: comprehension of the present environmental challenges may lead to expanded awareness of the correlation between one's actions and the present environmental situation. Ultimately, this can have as a result, a potential for successful promotion of efforts to alter the levels and modes of present social activities, which appears necessary in order to ensure a larger social change in a direction of more responsible living.

The location chosen for fieldwork is unique in many ways – in the Arctic, changes due to pollution, the climate change and effects on wilderness manifest rather quickly – the nature in this area is rather vulnerable. Svalbard is one of the most accessible places in the polar region and a place bursting with scientific research of the Arctic, with the capital Longyearbyen being somewhat of a blend between a small town and a cosmopolitan place. People in Longyearbyen live in the middle of a research area, and are come in contact with the members of the scientific community on daily basis.

More skillful articulation of esoteric knowledge and higher scientific literacy among the public appears to be imperative and the first main objective is thus identifying the obstacles for this to take place. In order to understand and conceptualize challenges within the relation between academia and society, I approach the phenomenon of science communication by attempting to understand the dynamic between the scientific and the local community in Longyearbyen. Exploring this dynamic lead me to establish a second objective, which explores the socio-political side of science-society relation through the effects of science-based decision implementation on local people's life practices, and their attitudes towards science as a result.

Regarding obstacles to knowledge articulation, the objectives are:

- Exploring the barriers to articulation of science from the scientists' perspective
- Exploring the barriers to understanding science, from the local people's perspective

Regarding the socio-political aspects of science communication, the objectives are:

- Exploring the life modes and practices in Svalbard
- Exploring the scientific knowledge applications and their effects on nature, local people and their attitudes towards science

By unveiling the topic of science communication I came across a variety of components which constitute this phenomenon. Thus, rather than narrowing down the research to one of the components and exploring it in depth, the thesis tries to give a comprehensive overview of the elements which constitute the current situation within communication of science. The results will hopefully become a convenient tool for further research which has an ambition of deepening the understanding of individual factors the phenomenon of science communication is comprised of.

1.3 Thesis outline

The thesis has seven chapters, including the introductory one where I presented the topic, reasoning behind the topic choice and the research questions. Second chapter will introduce the methodology, the informant selection, ethical concerns and the challenges of interdisciplinary. Chapter

Three will present the complex background my topic is set against. Fourth chapter is a theoretical landscape through which the topic is explored. Subsequent chapters are of an analytical nature – Ch. Five explores a variety of obstacles to more comprehensive science articulation. Sixth chapter investigates socio-political panorama of science-society relation, set against the natural environment of Svalbard. In the final chapter I attempt to arrive at the conclusion, through a brief discussion of identified obstacles which hopefully consolidates a more integral and enveloping comprehension of the phenomenon.

2. In search of a meaning

In this chapter I describe the scientific method I used in this research and the potential that this method has. I will also present how I approached the selected interviewees and conducted interviews. The ethical concerns as well as challenges of carrying out an interdisciplinary study are addressed in the end.

2.1 Research method

Qualitative study tends to collect data in natural settings, generating a theory rather than testing one (Brockington and Sullivan 2005:57). Thus the qualitative approach is rather suitable for the subject that I aimed to explore, since I sought an insight into attitudes, opinions and actions, in contrast to trying to obtain knowledge on actual facts or test a hypothesis. In a case of qualitative research interviews, many of the findings are directly linked to how a person interviewed perceives the world, and so in order to step into other people's worlds, I chose a method of "*understanding the world through interacting with it*" (Brockington and Sullivan 2007:57). Leedy and Ormrod note there are several purposes that qualitative research serves, and those relevant for my research are the ones which

> "[E]nable a researcher to a) gain new insights about a phenomenon, b) develop new concepts or theoretical perspectives about the phenomenon and/or c) discover the problems that exist within the phenomenon." (2005:135)

One of the main challenges that the chosen method is posing is the interpretative nature of the analysis, since as Berg notes, the data "*cannot be*

analyzed by running computer programs" (2004:2) but interpreted by the researcher. Collected through such method the data are susceptible to misinterpretation and manipulation, i.e. findings are also inevitably linked to how the researcher sees the world, thus the collected information are potentially unreliable. The researchers are facing a situation where they are the only ones in a position to clarify what informants might mean, so it appears essential to pay attention to idiosyncrasies, ways the informants express themselves and to listen for the subtext while keeping a sense of openness towards potentially arguable opinions. This interpretive nature of the method is, according to Berg why the method has been criticized as unscientific and even invalid (ibid.). However, Brockington and Sullivan state that if data collected through this method are treated properly, they can be just as valuable and relevant as numerical data (2007:71) and since this is the method that reaches beyond facts and observable occurrences, it is fundamental in a search for a meaning.

As I have shaped my research as the instrumental case study, the case itself is used as a tool to provide insight and understanding of a phenomenon explored, as the phenomenon becomes placed within a narrower context - in my research of an already presented scientific discipline and soon to be introduced defined location. Thus, the case obtains a "supportive role" (Stake 1994:237). Through the study of my informants' perspectives, I am attempting to understand what characterizes the relation between society and science, which are although tied to location and specific discipline of science, in many respects applicable on a global scale. In other words, I am attempting to make "a small step toward grand generalization" (Campbell 1975, in Stake 1994:238).

2.2 Selection of informants

Envisioning the goals of fieldwork, I adopted several criteria for the selection of the informants. When it comes to the local people in Longyearbyen, my focus was on an 'average person'. This means that I excluded those whose opinion is likely not representing the population on the island, such as e.g. members of the government, employees of the mining industry[3] or tourist agencies' workers. The reason for this is that members of these sub communities may at times speak from the position of their sub cultural and professional affiliations, thus mix personal and professional views or voice only their professional standpoint. Members of these subcultures may perceive the subject I am exploring in a considerably different way from an average citizen by virtue of their professional alliances. The other two criteria were, one - that informants would have to be Svalbard residents for a reasonably long period of time (I thought approximately 10 years is a reliable time) and two, be relatively comfortable speaking English.

The researchers at UNIS were selected by simply e-mailing those scientists whose research revolves around or is connected to environmental sciences in the Arctic. The scientists that were actually interviewed were the ones who replied to have interest and time for participating in my research.

In total, I have had conversations with six researchers at UNIS and six locals in Longyearbyen, five of them men and seven women. All of the UNIS informants are natural scientists. I have decided to leave all informants

[3] Sysselmannen and Store Norske Spitsbergen

anonymous, giving fictive names to the local people and leaving the researchers without names.

2.3 Depending on the kindness of strangers

I have stayed on Svalbard twice, two weeks each time. Both times, the interviews with almost all researchers were agreed upon before my arrival and for the most part, went without delays or re-scheduling. The interviews with the local people were, on the other hand, set only after I had arrived, by approaching each individual personally, which was somewhat time consuming and for a beginner in this kind of inquiry, also somewhat uncomfortable. Unlike with the scientists, interviews with local people were negotiated, sometimes several times and a number of those asked to be interviewed declined right away or canceled later on. The reluctance by many locals might have been aided by the fact that the interview would have to be conducted in English, and most local people are native in Norwegian. On the other hand, I was not able to conduct a meaningful interview in Norwegian at the time, thus the English language was obligatory.

It is evident that I was a stranger to all the people I approached, and the confidence in one's knowledge of science (which was not the topic of the conversations, but seem to have perceived by locals as having relevance) varied – thus, the understanding of the expectations and research topic I presented to my potential participants perhaps played a role as well. I repeatedly tried to clarify about being interested in *opinions* and not factual knowledge, but as much as I tried to make this apparent, I believe some still felt discomfort regarding their own scientific knowledge. What was significant for me to be aware of was to keep a neutral stand point and respect for every opinion I was presented with. Since my mission was to

learn from my informants and not the other way around, any potential disagreements on either opinions or facts were left unmentioned. This, I believe could have made informants feel less restrained when talking of how they truly feel and think, rather than trying to sound impressive or correct. All the interviews were recorded with interviewees' consent.

The interviews I planned to carry out in Longyearbyen resulted from my intent to use the qualitative method; they were of an 'open-ended' form, and in a relatively informal atmosphere – interviews took place in the local café, people's homes and work places (kindergarten, local store). All the interviews with the scientists were conducted in their university offices.

The same set of questions was used for every interview, but none of the interviews went down the same path, since it seemed unwise to cling onto the arrangement of questions on the expense of the fluidity of the conversation. I attempted to follow my informants' dynamics and pace and bring up topics of interest where they would naturally fit in the dialogue. Except in one or two cases, my interviewees did not have limited time, so the interviews went on in the natural conversation tempo (with a length between 45 minutes to 2 hours) and I had opportunities to ask about all the things I planned, while at times some unplanned information came up as well.

2.4 The Ethics of research

The ethical approach for a research requires that the collected data are authentic and reliable, and the interpretations of data are executed in an honest and fair manner.

The names of the participants, when given, have been changed, in order to protect their identities. All informants agreed to be recorded. All of the interviewees understood that participation was voluntary and that they could say no or back out at any given moment during the interview, although the latter did not happen and all interviews were completed.

As far as other ethical issues that often arise on field work are concerned, such as conflict of interest, confidential information, safety, or befriending locals, given the nature of my stay and topic, these I did not have to face. I had no time to befriend the locals. None of my participants seemed to be in a position to access confidential information, nor have I needed any. My informants seemed to speak in an open and frank way, and I did not feel at any point during my fieldwork that I was in anyway compromising my participants' "*dignity, privacy and safety*" (Scheyvens et al. 2007:140). Also, to make sure participants know they will be presented and interpreted in all fairness and honesty, all were offered to receive an electronic copy of the thesis once it is finished.

2.5 Thinking collectively - The challenges of interdisciplinarity

Identifying the barriers of interdisciplinary work makes it easier to overcome those barriers (Lélé and Nordgaard 2005:967); I am thus devoting part of this thesis to address the challenges I came across in interdisciplinary research and in hope these will be alleviated with time, enabling greater interdisciplinary activity.

Lélé and Nordgaard note that challenges arise from the very beginning - from choice of questions, theoretical positions, to style of research (2005:968). According to authors, those most conspicuous obstacles one

meets in interdisciplinarity are differences between disciplines in theories and explanatory models, differences in epistemologies and, thus, methods, as well as in fundamental assumptions and notions of proof (ibid.). Much of it turned out to be true in my case, and this issue is also addressed in some of my interviews.

Questions within an interdisciplinary study seem at times more complex than those in basic research, since they reflect an ambition to broaden the understanding of phenomenon studied individually by many disciplines but pose a challenge of having sufficient knowledge and broad understanding when transcending disciplines. Furthermore, due to my previous training in natural sciences, the theoretical positions and epistemologies I needed to use were not, unlike perhaps for those with social science background, immediately obvious to me thus identifying them took additional work and learning along the way. For a biologist to do a sociological study, many challenges are immediately posed by assumptions and expectations established by previous education. This affects not only selection of facts and topics that one wants to study but also suggests what the purpose of the research is, which questions to ask, and how to think about one's own research, ideas of what constitutes a research, and which notion of proof is valid. Ultimately, as Lélé and Nordgaard note, one ponders what kind of research provides the actual knowledge or 'the truth' (2005).

Carrying out an interdisciplinary research poses challenges of thinking and investigating beyond frameworks learnt and established by the traditional educational frame. It also entails identifying and questioning concepts which are taken as evident, expanding one's knowledge to enable comprehension of ideas that are broader in scope or perhaps unfamiliar or absent from

one's basic training as well as knowing which tools to include, where to find them, and how to use them.

Finally, I want to note that transcending disciplines is not followed exclusively by difficulties and this was excellently illustrated by Samuel Beckett. A native Irish, Beckett wrote many of his major plays in French. Although demanding as it is to write in a foreign language, Beckett however noted that this enabled him to avoid the cultural, historical and contextual burden that the use of native language inevitably brings into the work. Similarly, although by no means comparing myself to Beckett, when stepping into disciplines other than my own, I was unfamiliar and thus might have been unburdened by the concepts and frames which are constituents of any discipline and thus taken as obvious, perhaps avoiding to some extent subjectivity that comes with the field of sociology and humanities, something that happens less often when one keeps strictly to own study area.

3. The background and the context

It is becoming more and more challenging to comprehend the consequences of interconnectedness of today's world. The ever growing complexity of relations in modernized and globalized world is often times escaping our attempts to grasp and find meaning and guidance in it. The overwhelming amount, diversity, and versatile nature of information we are exposed create a labyrinth of meaningful and meaningless, which at times are hard to tell apart. One of the most relevant elements contributing to that challenge is the fact that our world is dominated by science (Durant et al. 1989:1, Ridley 2001:39) which is albeit "*the greatest achievement of our culture*" (Durant et al.1989:11), for many still inaccessible, incomprehensible and exclusive. It is considered that there is a substantial divide between the scientific world and the rest of society, and that this relation is characterized by antagonism and suspicion on the part of the public towards knowledge that comes from the academic community.

Inaccessibility and lack of comprehension of science is not the only cause of this divide. Despite science improving the quality of life tremendously, one could argue that in many respects the quality of life has been reduced as well – excessive pollution, endangered biodiversity and scientific discoveries such as nuclear power or genetic manipulation are posing a threat for everyone everywhere in the increasingly interconnected world.

Some of the applications of science which at times turned out to be imprudent, have lead to emergence of new challenges, several of which needed to be studied from novel angles, and jointly by many disciplines. The one I focus on - the environmental science is a combination of studies of the

natural environment, human activities and the consequences of these activities on nature and society.

I will now proceed by providing a background for the current interaction between science and society – explaining the concept of science and the controversial aspects that have likely contributed to the growing alienation. I proceed by narrowing my focus to environmental science and controversies within, to finally locate it in Longyearbyen, Svalbard, describing the kind of place Svalbard is, and its relevance for the research I carried out.

3.1 What is science (for)?

The word science originates from Latin word *scientia* – knowledge. The term can be applied to any systematically built knowledge based on facts; there is still no universally agreed definition of it (Durant et al. 1992:161). For example, Ziman perceives that what is considered science "*is sometimes defined very differently by different people - or even by the same people under different circumstances*" (1991:100). Many of those delineations overlap or complement each other, and I will briefly present some of them.

In "Consilience: The unity of knowledge" biologist Edward O. Wilson defines the science as *"organized, systematic enterprise that gathers knowledge about the world and condenses knowledge into testable laws and principles"* (1998:58). Wilson names five features of science that distinguish it from pseudo-science - repeatability, economy[4], mensuration, heuristics and

[4] Putting information into form that is both simplest and most pleasing thus achieving elegance, while yielding the largest amount of information with the least amount of effort (E.O.Wilson, *Consilience*)

consilience[5] (ibid.). Mathematician Anatol Rapoport lists the following principles as paramount in the practice of scientific investigation: conviction that something is objective truth, rules of evidence for discovering, unanimity of possible and desirable, independent arrivals at convictions – examination of evidence, and not coercion, argument or appeal to authority (Rapoport in Thomas and Durant 1987:8).

Historian Jan Golinski sees today's science as an "*outcome of a progressive accumulation of human knowledge, which was an integral part of moral and cultural development*" (2005:2), sociologist Robert Merton defines scientific knowledge as "empirically confirmed and logically consistent statements of regularities" (1973:270), while biologist Richard Dawkins offers more of a lyrical concept of science, as "*the poetry of reality*" (Dawkins, 2007).[6]

As the concepts of science differ, and the role of science is in society has also been debated, it seems impossible to assign one definite role or purpose in the society independent from the broader surrounding; according to the geneticist Richard Lewontin, science as social institution is completely integrated into and influenced by structures of all other institutions (1991:3). Science thus seems to be fulfilling numerous roles in social context, beside providing jobs, it is seen as enterprise with a goal of attaining the truth (Kitcher 1993:3), but also changing the material world, the way we confront that world as well as the quality of our own lives (Lewontin 1991:4).

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[5] "The Consilience of Inductions takes place when an Induction, obtained from one class of facts, coincides with an Induction obtained from another different class. Thus Consilience is a test of the truth of the Theory in which it occurs."William Whewell, The Philosophy of the Inductive Sciences

[6] The quote is taken from IWC Media film "The enemies of reason".

Today, science is seen by many as dubious and scientists as untrustworthy; many people distrust the information they receive (Ockwell et al. 2009:310, Durant 1999:313) and according to Durant society is today less optimistic towards science and technology than it was in the past (2005). In the next section I will try to explain why this might be so.

3.2 The murky side of science

Francis Bacon postulated that science provides a hope for a better world (Stent 1978:13; Ridley 2001:181). As noted, some believe that science is one of, if not *the* greatest achievement of our culture (Durant 1989:11) which brought much good to humanity (Lewontin 1991:3) and in many respects resulted in a better world. Scientific discoveries and applications have brought upon dramatic changes that the world is experiencing, some of which are highly advantageous – from increase of life expectancy and disease cures (UNESCO Declaration: 1999), radical improvement of living conditions in many places, increase in the production of food and other goods as well as the life expectancy (ibid.), to natural resources use, travel around the world, or fantastical enterprises such as travels to the outer space.

Science is often seen by lay people as an undebatable, final collection of absolute knowledge (Lewontin 1991:3, Durant 1999:315, Zehr 2000:88), however a great deal of it is in fact oftentimes provisional, and some of it even controversial (Durant 1999:315). In retrospect, the Baconian notion of scientific mission can be seen as utopian and naïve. In spite of its tremendous achievements, science has repeatedly been derailed from its mission for the better world, resulting in destruction, hazards and deteriorating living conditions for both human and non-human life, turning

at times scientific knowledge into a commodity that when compromised, has effects which are seldom, if ever revealed of even known. Reckless scientific applications with unforeseen effects have set off a change in the natural environment which, by now, might be irreversible. In addition, uses of science and distortion of knowledge to maintain authority and maintaining power have significantly undermined the credibility and reputation of science.

In this section I will present some of the possible reasons for what Durant calls *"general crisis of public confidence in science and scientists"* (1999:313). The first group of reasons is constitutional aspects of science, i.e. innate to the scientific method and practice. The second group is aspects of external nature - the practical uses and applications of science which have significantly undermined its credibility.

Characteristics of the scientific method causing confusion among lay people are changes of hypotheses, making mistakes, and scientific uncertainty all followed by disagreements between scientists. These four aspects all stem from incomplete scientific knowledge on the world, and seem to be controversial due to either lack of understanding on the part of the public of these being inherent features of science. Furthermore an omission on the part of the scientists to disclose, when addressing knowledge to the public, the presence of these features aids to the overall distorted ideas on science.

Since science is understood as an operating, authoritative, trust producing profession, complete in its knowledge and objective in its world view, changes in hypotheses and previously stated knowledge might cause suspicion in the actual knowledge that scientists possess. It is, however, known within academia that with the emergence of new information,

changes in theories often occur, thus no theory is the final truth. Proving a hypothesis to be false can brings about changes, from minor ones to those rather significant changes in the very epicenter of thinking about a problem, causing "paradigm shifts", and represents the so-called revolutions in science – a revision to existing beliefs and practices (Kuhn 1962/1996: 92).

At times, as in any other domain of activity, mistakes occur and the presumed knowledge can turn out to have been based on false premises causing suspicion in accuracy of scientific knowledge. However, mistakes and failed expectations can at times drive the science forward. The chemist Humphry Davy is known to have said: *"The most important of my discoveries have been suggested to me by my failures"* (Beveridge 1957:80). Indeed, encountering mistakes in one's own work may lead to either discovering a new problem or solution, or re-defining and clarifying the existing one, and *"those excessively cautious in their scientific investigation are not likely to make either errors or discoveries"* (ibid.).

Due to the noted perception of science as authoritative and trust producing, the concept of scientific uncertainty thus appears to be relatively obscure outside scientific circles and thus confusing when conveyed. Uncertainties are perhaps been kept unrevealed since, according to Zehr, openly disclosing uncertain knowledge can diminish the authority of science (2000: 87). According to House of Lords' "Science and Technology Third Report", this is the aspect that society has most problems with – understanding uncertainty and dealing with the risk, aspects which pose a challenge for scientists in terms of the assessment of the magnitude, evaluation of probability and communication of it (Ch.2. §2.50). An additional challenge is the fact that uncertainty and risk can be also misplaced and misidentified, or even be a matter of a political, and not a scientific nature (ibid.)

Finally, those working in research often disagree among themselves (Durant 1999:316, Norgaard and Lélé 2005:968, Moses and Knutsen 2007:3), claiming different, even contradictory assumptions to be truths. Since many scientists tend to think that their way is the best way of presenting reality (Norgaard and Lélé 2005:969) the result is a perplexing effect on the non scientists and again, a doubt whether the scientists really know what the actual case is.

The external reasons for a dubious reputation of science originate from unfortunate applications of knowledge, which have not only failed to provide a better world, but have arguably created a world in many respects worse than we could have foreseen.

Many scientific applications and technology seemingly aimed to increase public welfare have had nonetheless unfortunate implications (Stent 1978:132) – especially in insufficiently explored areas of genetically modified foods, cloning, pharmaceuticals, pesticides and others (Durant 1999:316), or by being developed and used to promote armed conflict, namely the nuclear, chemical and biological weapon (Ridley 2001:181, Stent 1978:131-132,), supportive of and promoting gender, societal, national, racial and cultural inequality, and maintaining an unjust political and social order, finding explanations for power relations and imperialism in 'scientific facts' (Asdal et al. 2007:10, Lewontin 1991:19-37) and maintaining and broadening social inequality between different parts of the world (Norgaard 1994:2, Durant 1999:317). Moreover, a plenitude of risks to environment and human health, badly evaluated, unforeseen or brought upon due to science being used, as Asdal et al. note as a tool by those who had power (2007:10), made science and technology look like a *"poorly controlled experiment conducted on society as a whole"* (Durant 1999:317). All of this

eroded the belief in science as a neutral and progressive force (Asdal et al.2007:10).

Economist Adam Smith observed that academic science feeds off new problems and discoveries in technological arena (Desrochers 2009:9) and so the new disciplines that have emerged from some of the unfortunate applications of science will be presented in the next chapter.

3.3 The environmental science

Environmental science is a cluster of disciplines, i.e. interdisciplinary area where different sciences meet in the study of the relation between humans and the natural environment. Their research focuses on human relation to and impact on nature as well on solutions for environmental problems, use and management of natural resources and protection of nature. In this section I will introduce those areas of environmental science which are of interest for this thesis. As the awareness of risk rose with the intensification of environmental degradation, new scientific branches started to consolidate themselves and the growing urgency of re-assessing human utilization of and relation to nature was becoming more evident.

Nature writers and philosophers commenced the environmental awakening and interest in recreation in nature already in the mid 19th century[7], while according to Gandy, several major environmental issues that came into focus in the mid 1960's gave a propulsion to modern environmental movements (1996:26), delineating the research area of what is going to become an environmental science domain. The development of science and the

[7] The most prominent movement at the time for nature preservation is known as Romanticism

application of technology have produced novel events resulting in excessive pollution, mainly in a form of intense pesticide use, discharge of industrial chemicals into natural surroundings, acid rain[8] and more recent destruction of the stratospheric ozone layer. All of the above have had and some are still having devastating effects on both natural environments and human health.

The harmful effect of pesticides is recorded already in the 1960s in all parts of the world and in every living organism and ecosystem on earth (Carson, 1962). While acid rain and ozone depletion has been successfully tackled by policy changes and thus taken off the list of concerns, the environmental degradation and animal and human poisoning caused by pesticides, and industrial chemical discharges are not subsiding in many parts of the world (Eddleston et al. 2002 :1163), in spite of the increased awareness of the danger the chemical industry poses.

Scientific research which revolves around environmental degradation seems to be causing more debate than most other sciences in recent years. Over the last four decades, academic and public attention has been directed towards these environmental problems, only to be finally captured by an unprecedented environmental situation, culminating in an enveloping challenge – the global change of climate, around which a novel research disciplines assembled.

When talking about present climate change, most experts now agree that human activities in the last 50 years have at least contributed, if not set the present change of climate in motion. In 2001, national science academies

[8] Precipitation containing higher than natural percentage of sulfur and nitrogen, from the industry and vehicle emissions

from 17 countries signed a joint statement published in the journal *Science*, which endorses the work of International Panel for Climate Change (IPCC) as credible and states that *"human activities are already contributing adversely to global climate change"*.[9] The IPCC 2007 report notes:

> "Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG [green-house gases] concentrations. It is **likely** that there has been significant anthropogenic warming over the past 50 years averaged over each continent (except Antarctica)"

adding that the sum of naturally occurring activities such as solar and volcanic, would likely have produced cooling.[10] Considering that the work of IPCC is recognized to represent the consensus of the scientific community, when it comes to climate change causes and consequences (Ward 2008:19) it seems by now reasonable to take it as certain that the climate on our planet *is* changing and to a large extent is due to the increase of greenhouse gases emitting human activities.[11] Nonetheless, despite of the apparent certainty in the sources of present change of climate, the research on climate change has been an endless source of controversy and disagreements, as

[9] http://www.sciencemag.org/cgi/content/summary/292/5520/1261

[10] http://www.ipcc.ch/publications_and_data/ar4/syr/en/spms2.html

[11] The certainty of the climate change causes is of great relevance – the changes in climate are believed to already having a multitude of effects on both nature and society across the world – from changes in annual cycles in flora and fauna, effects on biodiversity, sea levels, extreme weather, changes in precipitation patterns, changes in carbon cycle leading to negative effects in agricultural yields, land fertility, and food and water supplies, further causing sanitation problems, settlement damage due to floods and storms, spread of water and air borne diseases, mass human migrations and others.

well as being relatively unsuccessful in relating issues of climate change to one's daily life and this has yet to forge a global and a unanimous initiative towards reduction of climate change causes.

Beside the pollution and the climate change, the protection and management of nature has not been without controversy either. Conservation of nature has long been a source of debate, and the pressure put on nature for resources grows with ever growing human population and needs. According to Sikor and Lund, powerful groups and institution still conduct political decisions on the rights to access to natural resources (2009:1). In the British Empire, the promotion of national parks concept in colonial Africa came mainly from politically powerful English society, rather than professionals (Neumann 1998:186). Today, many of the decisions regarding conservation are made in cooperation with professionals, i.e. scientists who evaluate, based on what is to be understood as neutral facts, the importance of sites and the level of restrictions necessary. Although many nature reserves are not a source of livelihood anymore, particularly those in Europe and the US, the dispute over whose rights and interests are to be fulfilled through nature is very much a controversial issue still. Often times, nature reserves can still be perceived as a fulfillment of interests of politically powerful groups or societies, which scientists are now seen to be a part of.

The challenges from individual sciences that are joined here might at times work in synergy. The complexity of individual subjects which can be enhanced when subjects are combined in research, poses a substantial challenge for environmental science and this appears to be often reflected in conveying knowledge these sciences obtain. In addition, different political and economic interests within the area of environmental protection are perceived as affecting the predictions and proposed solutions, blurring the

reality and aiding to a pronounced appearance of science as untrustworthy, corrupt and biased.

3.4 Public Understanding of Science

The idea that science and scientific work need to be conveyed and explained to the public first appeared in 1985 in a report "The public understanding of science" or the Bodmer report[12], after which the title phrase itself came into prominence and use (Durant 1999:313). The tendency for scientific research to retreat away from the public became obvious, increasing the awareness that indications of the trend are potentially harmful for both academia and society at large (ibid: 314). One of the major effects of the trend of scientific activities detaching from society was a crisis of trust (Durant 1999:313), an outcome of science becoming a remote and unfamiliar concept for most people. In 1969 science historian Hunter Dupree marked the isolation of science from the rest of the society in the US as a "cargo cult" where, due to the failure to understand science, the public response was fear and adulation (Thomas and Durant 1987:6). Considering this trend, it is not a paradox that as Zimman notes, so many people have little understanding of science despite of it being an element dominating our culture (1991:99).

The interest in the public and its knowledge about science reemerged when, according to Wynne, public ignorance on science led to cultural alienation, culminating in apathetic and even hostile attitudes towards science that surveys exposed (Wynne 1992:38). Thus, the publishing of the Bodmer Report was an attempt to bring attention to the urgency of reversing this

[12] The report was named by Sir Walter Bodmer, a British human geneticist, who chaired the Royal Society committee which wrote the report

trend (Turney 1996:1087, Miller 2001:115). The Report argued that "*scientists must learn to communicate with the public, be willing to do so, and indeed consider it their duty to do so*"(1985), and parts of the academic community began to show concern for the gap between science and the rest of society, and to view this gap as unacceptable (Duran 1999:314).

For more than two decades now, scientists in Western Europe have been continuously encouraged to work towards bringing their endeavors closer to the rest of society (Miller 2001 - quoted in Davies 2008:413, Turney 1996:1087), while in United States, the interest of including the public in technology assessment (TA) commenced some decades earlier, with the beginnings of the TA movement in the 1960s (Durant 1999:313). By the mid 1990s promoting public understanding of science was officially part of the UK Government science policy (Durant 1999:314) and public trust fund and associations give out grants for efforts within popularization of science (Davies 2008:413).

The 1996 follow up survey in Britain tried to identify the effects of scientific opening in the country. However, the results showed that the efforts to bring science closer to the public seemed to have made no significant difference (Turney 1996:1087, Miller 2001:116). According to surveys, the *interest* in science remained high indeed, even the confidence in scientists was rating high (ibid.) - a poll from 2001 showed that 84% of Britons thought that "s*cientists and engineers make a valuable contribution to society*" while 68% think that "*scientists want to make life better for the average person*" (May 2001). However, general knowledge and understanding of science, i.e. scientific literacy, did not change notably (Turney 1996:1087, Miller 2001:116).

In 2000, the British House of Lords published "Science and Technology – Third Report" that noted "*society's relationship with science is in a critical phase*". The Report shows somewhat different results from surveys four years earlier: it states that though people take technology and science for granted in everyday life, many still show concern regarding rapid progress of technology and IT development, indicating a crisis of confidence in scientific advice (Ch.1, §1.1.).

In terms of decision making, in the last twenty years it has become, according to Miller increasingly apparent that public policy debates need proliferation of those scientifically literate enough to participate (1998:203). The governmental awareness of the levels of public science illiteracy and the number of initiatives related to the issue have hence grown accordingly, however the agreement on the best methods for increasing the literacy in question has not risen yet (ibid.).

When it comes to environmental science, climate change and environmental degradation are topics which are highly represented in the media (Featherstone et al. 2009:216, Olausson. 2009:421) and appear to enjoy a status of high priority on the part of academia, international organizations and political bodies in terms of communication of these sciences. However, among the members of the public, environmental problems seem to be taken as something remote from their lives, changes that will affect future generations and 'other' people (Ockwell et al. 2009:309).

The initial way of perceiving the problem of understanding science was to put responsibility on the 'ignorant public', which simply needed to know more about science and technology, seen as unproblematic body of definite knowledge, and that scientists were the experts whose role is to disseminate their knowledge (Durant 1999:314-315). This is known as the 'deficit

model', based on "public deficiency, but scientific sufficiency" (ibid; Miller 2001:116). Recently, a number of critiques of the deficit model argued that it is a variety of factors, most of which are discussed in the previous chapter, which have led to the contemporary attitudes to science in society, but there has not been a singular proposed substitute model for the 'deficit 'one yet (Durant 1999:314-315).

The multiple, ambiguous phrase *public understanding of science*, according to Durant, is not classified under any single paradigm which would offer a cohesive explanation (1999:314), or help guide research and applications of interpretations. As the author observes, many different professional and social groups have joined in the initiative to bring science closer to the rest of society. Due to bringing in different assumptions, definitions and aims, no single framework managed to accommodate a vast variety of interests and goals (ibid.) which might be one of the major obstacles to defining the phrase and work towards possible resolution in initiative to bring science closer to the rest of society.

What makes the phrase multiply ambiguous is that it consists of three terms, each of them needing an explanation. As I elaborated on the notion of science in the previous chapter, I will now present two other constituents of the phrase.

Who is the public and what kind of understanding?

According to some authors there are many different publics, i.e. science communication does not deal with *the public*, but with particular and different publics within a certain context (Turney 1996:1088, Davies 2008: 428, Featherstone et al. 2009:214). As the public cannot be seen as a uniform group, with the same beliefs and levels of knowledge, Zehr suggests

that studies of science communication might need to focus more on questions *"which audience, in what context, looking for what information?"* (2001:86), in order to recognize their target audience, successfully forge interest and increase scientific knowledge among members of this particular public. Levy-Leblond argues that we need to shift the focus that has been on the public ignorance to the responsibilities that the scientific community has when addressing their audience, and has thus coined a phrase '*understanding of the public by scientists*' casting the light on the need for academia to recognize the heterogeneity and diversity that constitutes 'the public' and their interests (1992:17).

It is also rather unclear what sort of understanding is implied by the 'public understanding' phrase (Durant et al. 1992:161, Turney 1996:1088), as understanding can mean anything from sympathy to comprehension (Thomas and Durant 1987:2). There have been attempts to clarify the meaning - Miller describes the scientific understanding as that which *"might include everything from reading the label on a package of food, to repairing an automobile, to reading about the newest images from the Hubble telescope"* (Miller 1998:204), while John Maddox, science writer and former editor of Nature, on the other hand, argues that understanding would be comprehending what the scientific process is like, rather than knowing the structure of DNA (Turney 1996:1087). Scientists participating in interviews about their perceptions of public understanding of science expressed similar attitudes - the relevance of people grasping the reasons of doing science and reasoning entailed in this work, rather than the names of the studied enzymes (Davies 2008:417-418). In the same fashion "Science and Technology- Third Report" points out that the 'understanding of science' assumes familiarity with the scientific method, scientific research advances

and implications rather than possessing extensive knowledge on different scientific fields (2000: Ch.3, §3.1).

Why scientific understanding matters?

Arguing that the understanding of almost anything by anyone is good in itself perhaps seems unnecessary, and Thomas and Durant note that public understanding of science *per se* is regarded as a good thing (1987: 3-9). Nonetheless, I will provide a quick overview of reasoning by advocates for public understanding of science.

Some scientists see moral and social responsibility regarding their work as a paramount, in particular the responsibility towards environment and society where there is a risk and uncertainty involved, which implies the necessity of conveying the knowledge (Myhr and Traavik 2002:81). The "Science and Technology - Third Report" identifies one of the obvious benefits as improvements of chances for coming generations to find careers within science and thus work in society's best interest. On a broader societal level, The Third Report presents understanding as a crucial aspect of democratic and open society, as it is of great importance for citizens "*to comprehend, criticize and use scientific ideas and claims*" (2000: Ch.1. §1.11).

Furthermore, as the research is often publicly financed, a minimal level of understanding on the part of the public of what the research is about is needed (Durant et al 1992:163).[13] Then, the democratic rights in society include public participation in decisions, and since many public policy decisions are based on science and the ramifications of decisions may affect

[13] This argument is however somewhat narrow in application, since it does not stand if the financing of research comes from the private sector.

anyone, it is a democratic imperative that these decisions involve public debate (ibid., Maillé et al. 2010:70) as democracy makes sense only if members of the public have sufficient knowledge to make a decision. Ensuring democratic rights of citizens has further positive development - the functioning of democracy itself depends on public literacy, and scientific literacy is a part of it (Durant et al. 1992:164). A variety of other positive effects of increased public literacy are relevant to mention - benefits to science itself, national economies, national power and influence, benefits to an individual (intellectual) and to democratic governments themselves (Thomas and Durant 1987: 3-9).

In terms of environmental science, it is highly relevant whether and how people understand and relate to these issues, on individual and societal level. This seems to be crucial for further engagement in reducing the environmental impact of society, and in the next section I discuss the relation between the public, environmental situation and the science.

The public and the environmental science

The reports on urgency for action to mitigate climate change have flooded the media over the last 10 years, overshadowing to a certain extent many other environmental issues. This could be the case due to the fact that the climate change is encompassing phenomenon, while foe example the pollution and nature management disputes may be seen as more local (or at least less global) ones.[14] On the other hand, climate research has not captured attention of the non scientists - many have noticed the interest in climate research that the public is showing has not solidified yet.

[14] This is however not the safest standpoint, as I will discuss later both pollution and nature protection are global issues.

Bord et al. note that the unease regarding global climate tends to wax and wane, according to the attention given to the phenomenon by the media, in addition to its dependency on the weather changes (2000:205). For example, the public concern was at its peak after the 1997 UN climate change summit in Kyoto, and is notably high during very warm summers (ibid., Zehr 2000:88).

Several campaigns in the UK managed to increase the awareness on environmental issues, but were unsuccessful in motivating the British public to take action (Ockwell et al. 2009:306,310). Bord et al. found that the participants in their research are largely uninformed about both *nature* of global warming and environmental *consequences* of individual and societal behavior. The authors note that many researchers thus assume that what is needed is public education on climate and environmental changes in order to deal with misunderstandings and lack of engagement. However, similarly to mentioned attitudes regarding understanding of science in general, Bord et al. believe that more relevant is the ability to connect climate change to environmental problems rather than obtaining more knowledge and understanding within the subject, since mere knowledge increase might not be enough to stimulate the right response (2000:206). Evans and Durant agree, stating there has been very little investigation on whether a greater understanding indeed leads to more positive attitudes towards science (1995:57). For example, a survey conducted by Ockwell et al. shows that more than three quarters of the participants do know what particular habits and behaviors contribute to the warming of the atmosphere, still less than one quarter believes that the public in the UK is willing to change its habits (ibid.). Some surveys suggest that many believe the climate change will not have any effect on them personally and fail to act in spite being aware of the phenomenon itself (Bord et al. 2000:205).

As there are surveys that indicate the more the individuals are involved in the decision making process, the more likely are they to follow the changes imposed by decisions (ibid: 315), one of the reasons might be feeling excluded from decision making processes and being disempowered, and so the social relations and amount of influence citizens have cannot be neglected. Finally, there are currently different climate change scenarios, largely supported by various scientific and interest groups that describe the issue in dissimilar ways, proposing contrasting solutions and suggest contesting standpoints, perpetuating the bewildering atmosphere surrounding the climate change saga. Some of these proposed possibilities are contesting one another, such as the ideas proposed by James Lovelock in The revenge of Gaia (2006) and (until recently) uncompromising environmental skepticism of Bjørn Lomborg (2001).

To sum, numerous reasons why the general public does not react in accordance to the level of threat that global climate change is posing are suggested, both individual and social, from insufficient knowledge, skepticism, and distrust of information, perceived inaction by others and other priorities and values on an individual level, to social norms and physical or infrastructural impediments to the fact that the 'greening' is not seen as attractive enough to get engaged in and it is too often expected that it is the governments that should take actions. (Ockwell et al. 2009: 310).[15] In addition, environmental and climate science are complex and uncertain, and are also global and long-term issues, which makes them particularly

[15] The suggestion that people expect the government to solve environmental challenges is somewhat debatable - the UK government had to recall several of the policies introduced to reduce carbon dioxide emissions due to demonstrations and protests (Ockwell et al. 2009: 313).

difficult to understand and relate to at the individual level and in present time (ibid.) and so according to Featherstone et al. what to do about it is still very much an open debate (2009:216).

3.5 The location

In *Fundamentals of ecology*, Eugene Odum presents the Arctic as a site of great interest for ecology since this ecosystem is characterized by simpler processes than other ecosystems. Due to the limiting factors such as temperatures and light in the region, and very few types of organism which became adapted to conditions here; the simplicity of Arctic ecosystems is manifested in presence of fewer organisms and thus fewer relations and interactions between. Grasping basic and simplified relations can, as Odum notes facilitate understanding of more complex conditions elsewhere (1959:48-49).

Similarly, the society in Svalbard can be seen as simplified in comparison to larger communities elsewhere. On the other hand, the combination of intense scientific activity and cosmopolitism uncommon for such small communities and the proximity of wilderness make it a rather unique site to study phenomenon of science communication at.

The Arctic evokes an image of intact and pristine environment, one of the very few cubbyholes that seem to have escaped the fate of other natural environmental regions, some of which are crumbling due to nature degradation. To understand the relation between the science and local people in Svalbard, it was significant to investigate the standpoint from both sides. The natural and social idiosyncrasies of a place influence and shape the lifestyle and ways of thinking and acting, thus the elaboration on life and

the environment on Svalbard seem relevant for further comprehension of the results of my fieldwork. Moreover, it might also aid to distinguishing between circumstances entirely unique for Svalbard and those which can be applied to society at large.

Geography and history

The archipelago of Svalbard is positioned from 74°N to 81°N and from 10°E to 35°E. More than 60% of the 62.000 square kilometers land area is covered by permafrost. The islands of Spitsbergen, Nordaustlandet, Edgeøya, and Barentsøya are biggest islands of the archipelago, which includes many other smaller isles. Svalbard has little rain and relatively mild climate, compared to the same latitudes in Canadian and Siberian Arctic, mean temperatures are 15-20 degrees higher in Svalbard. The west coast is ice-free for most of the year (Norwegian Polar Institute webpage).

The capital, Longyearbyen, lays at 78°N and 16°E on the island of Spitsbergen, the largest island of Svalbard archipelago (ibid.). Longyearbyen is a small community of 2040 people at the time of my visit, with a population that is an international mixture, although the majority of residents are Norwegians. Originally a mining colony, the town is today also known after its cosmopolitan scientific community specialized in arctic research. Those that are not part of these two main groups come here mainly with their spouses or in search for a life change, and find work in different public services, such as the school and kindergartens, the supermarket, health and governmental offices as well as tourist organizations.

There are no records of human activity in Svalbard before 1596, when it was discovered by the Dutch explorer William Barentz (Kaltenborn and Emmelin 1993:44). The history of Svalbard is divided in periods defined by different

resource exploitation and export. The international whaling period was started by the Dutch, German and British whalers at the beginning of the 17th century. By the early 18th century, Russians were active sea and land mammal hunters in the islands. Norwegian hunting started in the mid 19th century, and a decade later the researchers and informal expeditions arrived. This was a convenient place of rest on a journey to the North Pole, and a source of the knowledge on geology, ocean currents, climate and wildlife provided to the scientific *milieu* in continental Europe. At the turn of the century, coal mining began at Svalbard. As of the early 20th century, the Svalbard community was established around mining, which besides coal, for a period of time included other valuable commodities such as gold, lead, zinc and copper (Governor of Svalbard 2008/a). Svalbard, and namely Spitsbergen, is one of the most accessible areas in the Arctic with tourism starting over 100 years ago. The archipelago never had indigenous population, while it has remains of activities and ventures of many different nations for the last 400 years (Kaltenborn and Emmelin 1993: 41-42).

The nature, life and science

Changes in the Arctic natural environment happen very fast, as the ecosystem is, due to its simplicity rather vulnerable, and environmental disturbance, thriving natural resource exploitation and the rising tourism are creating a significant pressure (Kaltenborn, 1998:169-170). National and local government are putting work into restricting the recreational use of Svalbard nature, and many of the areas that are of significance for science and preservation of wildlife are protected now. Around 65% of the entire area has a protected status, of a national park, or a nature, bird and geotope

reserves.[16] Aside from the natural heritage, protection includes the historical memories as well, as all traces of human activity older than 1945 are protected as cultural heritage of the islands (Governor of Svalbard 2008/a).

The fauna on Svalbard consists of terrestrial mammals such as the Svalbard reindeer and the arctic fox, marine mammals - seals, walruses, whales and polar bears[17], few bird species and one freshwater fish species. The polar bear has been protected on Svalbard since 1973, with a population of some 3000 individuals today (ibid. /b).

The flora on Svalbard is typical tundra vegetation, and it appears rather modest; as I mentioned only organisms which managed to adapt to the climate in the arctic can be found here. There are, in spite of vegetation's humble appearance, 170 plant species. Due to weather conditions and, in particular strong winds, there is no high standing vegetation, nor trees (ibid. /c).

The largest town here is Longyearbyen, with mining, tourism and scientific research as main occupations. The community is entirely dependent on supplies of everyday necessities from the Norwegian mainland; it is not even possible to be born in Svalbard as there is no birth clinic here - giving birth is arranged in Tromsø.

The town itself consists of one main street, with all public facilities aligned along. There is one supermarket in Longyearbyen, with a polar bear exhibited at the entrance, and bears can also be seen in the local fur store

[16] Significant geological areas

[17] The polar bear is considered to be marine rather than terrestrial mammal

and the Svalbard museum. The images of the polar bear is everywhere - from the supermarket, souvenir shops and restaurants, all have reproductions of polar bear images –pictures, postcards, toys, and jewelry. The actual polar bear is a rare site in the town. Travel outside is usually required to encounter one, but not before having a weapon license and a course on the wildlife protection and survival.

At one end of the main street lies the University Center in Svalbard (UNIS) and at the other is a small campus - student dormitory facilities. The UNIS building also includes the Svalbard museum, with exhibition of natural and historical artifacts, the Norwegian Polar Institute office[18], and Svalbard Science Center.

Svalbard is teeming with scientific activity. At 78° N, UNIS is the northernmost institution that offers higher education and research. Established in 1993, UNIS is specialized in arctic studies. Its geographical position gives an exceptional opportunity to live and carry out research in the same environment. University in Svalbard is a highly international *milieu*, with 41 informants and some 120 guest lecturers from around the world. UNIS has four departments assembled around studies of arctic biology, geology, geophysics and technology. It offers courses on undergraduate, graduate and postgraduate levels, and students attending these courses, both Norwegian and international, usually reside here for one semester (UNIS webpage).

[18] A directorate under the Ministry of Environment with headquarters in Tromsø

3.6 Summary

This chapter gave an overview of the background information I viewed as necessary for continuing with the theoretical and analytical section of the thesis. I presented nomenclature that will be used in discussing the results; as some of the terms are rather loosely defined it was relevant to reflect over the ambiguity within the terminology and the potential for misinterpretations when applying these terms.

Science itself is vaguely conceptualized – there is no universal consensus on the definition, although most scientists agree on some common features of science that usually help define what kind of enterprise science is. I introduced some of the common but perhaps less known features of science, which in synergy with described misuse and manipulation we have witnessed over time, have significantly undermined credibility of science.

As the phrase 'public understanding of science' has been criticized as unclear and ambiguous, I have proposed explanations for the terms the phrase consists of and how the terms can be applied. Evidently, there is no one homogenous public and the meaning of 'understanding' that is implied can vary. These terms continue to be used in the thesis for reasons of convenience; it is however important to keep in mind that the terms are provisional, and need to be more closely defined in every specific situation.

The environmental science are seen here as paradigmatic; the features such as complexity, variety of interests and seeming remoteness from everyday activities make them an excellent example for the challenging enterprise of conveying and understanding expert knowledge. In addition, I have also addressed the issues of science communication's importance and the role it can have in society today. Finally, the attributes of Svalbard where the

researched science communication takes place is presented, as the overview of its geo-historical characteristics, as well as of its contemporary features may help to clarify reasons for my choice of the location and provide an ambience for comprehending the analysis.

The background information provide a picture of the current situation within science-society relation and it is where I start my investigation in a hope that further exploration will take me beyond the obvious.

4. Through the looking glass

Social occurrences can be observed through a variety of angles, and on which level a phenomenon is understood depends on the approach one takes. I have chosen to observe my topic through the light of a sociological world view that describes the essence of *modus operandi* of today's society and the position of science and communication in it.

The changes that have been taking place in our global society for the last three centuries have commenced an immense transformation of modes of life and of the world in general. These changes and their ramifications have been assembled under a concept of *modernity*. According to Giddens, in the last three hundred years "*the modes of life brought into being by modernity have swept us away from* ***all*** *traditional types of social order.*" The author explains further that these changes were not always sudden nor discrete, in many respect there is a degree of continuity between traditional and modern societies, but that it is the extent and the intensity of these changes which is more dramatic, profound and comprehensive than in earlier societies. These changes Giddens classifies in three categories: the pace of change characterized by extreme rapidity, the scope of change - which spans across the globe, as well as the emergence of modern institutions (political systems and inanimate power sources) (1990: 4-6).

According to Giddens, the dynamism of modernity manifests itself through concepts of transformation of *time and space*, *disembedding* social systems and *reflexivity* (ibid: 15-16). The creation of "empty" time lead to universal time with measuring time in a same way around the world and having same time everywhere in the world (with some differences in hours).

Interdependence and interconnectedness of the world lead to a creation of an "empty" or a *global space*, which is contrasted to more pre-modern local notion of *a place* (when space and place corresponded). This "*emptying of space*" enables local events to be shaped by remote ones.[19] In addition, empty space is also characterized by the absence of face to face interactions (ibid: 18-19) which will be discussed more soon. Indeed, neither of these concepts are entirely absent from pre-modern times, nor it is possible to apply these fully and in every case in modern society; many local events can be to a degree locally shaped and at times, interactions with impersonal entities can take a personal form. However, the presence of these features in society is more pronounced than ever before.

Dissembedding is defined by the author as "*lifting out the social relations from local context of interaction*" onto the global context. There are two mechanisms of disembedding says Giddens, *symbolic tokens* - media which are passed on without regard to specific characteristics of individuals or groups that handle them, while *expert systems* i.e. systems of technical accomplishment, is the other (ibid: 21- 22). Often, as it will be discussed later, separation of time and space and disembedding coincide, and can be seen as in synergism conditioning the life today.

The reflexivity of modernity is according to Giddens "defining characteristic of all human actions." Reflexivity is thus a feature which is in the basis of our modes of living, meaning that all actions are constantly reflected upon and re-appropriated (ibid: 36-38). The past is being examined and possibilities are projected into the future, and almost every if not every social occurrence

[19] Creating an empty space is in fact globalization, which Giddens defines as intensification of social relations that connect local events to remote ones, influencing one another (1990:64)

is today being debated over and re-examined. In terms of science, as it will be discussed more in details later, “nothing is certain and nothing can be proved” (ibid: 39), that is all of knowledge is permanently in question, and continuously re-evaluated.

In the modern society, through rapid information exchange and across-the-globe interactions, science and technology have advanced tremendously. These have been, accordingly, perpetuating transformation of life modes bringing dramatic changes in terms of ways we communicate, relate to and essentially see the world. Individual’s position and value in society, as well as the amount of influence one can have in the society, have also undergone changes through the modifications of the social order. In the light of these profound changes, I will present several theoretical concepts which are elementary for interpreting the results of my fieldwork.

4.1 Communication, technology and nature

According to Littlejohn and Foss, communication is the transmission of information, where this transmission can, but does not have to include, the intention to affect the receiver’s behavior (2008:3). Communication is also a human faculty and comes in many different forms; it intends to convey a message, and the message is what contains the meaning. A word, a sound, an image, a movement or an action as well as their absence are all tokens serving as the vehicles for a message. Without the message, communication is devoid of meaning and thus meaning-less.

Due to modernity being inherently globalizing (Giddens 1990:63), communication in general is transformed to meet the needs of a rapidly connecting and interdependent world. In modernized society, by

technological expansion, the pace, scope and the nature of information transmission changes. The flow is accelerated to the extreme rate, spreading around the world, the amount of information released is ample, and the nature of information and the modes of dissemination become, due to the frequent absence f face to face interactions, largely impersonal.

As most parts of the world are interconnected today, the amount of information which we receive about the world with enormous speed is proving difficult to keep up with, while at the same time it appears that this created availability of information on everything and from everywhere. Communication in the modern society can be viewed both as alienating, as it oftentimes happens in a form of a faceless interactions thus without close and personal encounters, but also as a possibility to have new personal experiences, create and maintain relations despite vast distances, as well as gain all sorts of knowledge from across global space.

Impersonal relations that characterize accomplishing everyday tasks have replaced more intimate relations with fewer people we use to come in contact in pre-modern societies. As Giddens notes in traditional society it was easy to single out *a stranger* (1990:118), while today, we live among strangers and communication is shaped by estrangement. In terms of conveying scientific knowledge, this can mean that often times generically produced information is released into a void, without any knowledge on the receiver and his or hers concerns, or providing a context from which the information comes.

Longyearbyen has characteristics of both a pre-modern community and of a modern society. For example, citizens of Longyearbyen might be interacting with one another on daily and personal basis, as most people know each

other; at the same time these citizens might feel excluded from meaningful scientific information communication that take place in Svalbard – as the information might not be directed to the citizens and their concerns, but it tries to aiming the 'general public' and all kinds of circumstances. In some cases, the information might perhaps not be directed to anyplace in particular, but addressing the global space and general public.

For interpreting my results, it is an imperative to note that these changes which modernity has brought have by all means altered the ways we relate to nature on both societal and scientific level. Furthermore, modern technological development has resulted in a possibility of an unprecedented studies and utilization of nature, which entails nature experience as well and our perceptions of nature. Technology is both providing and contravening the possibility to grasp and experience the natural world, by making it accessible it is also making it distant by limiting, due to its own limits, what we can experience, and by transforming our perception of nature as well as the very nature itself. In studies of nature, the tools we can use today can provide an exceptionally detailed portrait of the studied phenomenon or its sublevels, yet as I will discuss more later, it does little to identify the position of the phenomenon or to identify its relations in the rest of the world. In terms of nature experience, the use of technology is often implicit, where while searching for wild nature we encounter some kind of a naturo-technical hybrid experience, where the border between natural and technological realms is blurred.

4.2 Abstract and expert systems

The emergence of the modern institution, characterized by abstract systems, i.e. inanimate power-holders, and the relation between these systems and

people is a defining element of the modern society. Part of the abstract systems is an expert system – i.e. systems of professional and technical knowledge, that most people do not have expertise in.

What Giddens sees as essential to the functioning of a modern society is the *trust* which lays in the fundament of our relation with these systems (1990:28-29). In many if not all spheres of human activity, from government to academia it is inescapable to rely and depend on someone else's knowledge and expertise to sustain the conditions in which we materialize our modes of living. This implies the trust in competence and reasonable conduct of these abstract systems, and is essential for the nature of modern institutions (ibid: 26).

These abstract systems are both a cause and a result of the communication transformation and the technological use – we seldom meet actual employees of these systems, and communication is frequently carried out via technological media, enhancing the depersonalizing process. Even when encountering an actual person, our interactions are largely, although not always, impersonal.

As Giddens notes trust in these systems does not presuppose encounters with individuals involved in them. On the contrary, in order to avoid revealing imperfection and fallibility, which would debilitate the authority these systems have, it is necessary to maintain the obscure and impersonal nature of these systems, so the frequent absence of personal encounters is

necessary to maintain the co-presence of abstractness and trust[20] (ibid: 83-86).

For instance, while some local people have been pointing out that they are content with the local government informing them regularly on different nature management regulations, at the same time, they were discontent that they are not partaking in the discussions over these regulations, or with the impression that some the government in the Norwegian main land makes decisions regarding their closest surrounding and thus, conditions their everyday practices.

4.3 Citizen power

In contrast to traditional societies that used to consist of smaller communities, where the local people and events in their surroundings were not detached from one another, in a global society the decisions concerning and affecting citizens are often made on higher levels of state organizations, and by remote entities (Giddens 1990: 80, 83-88). With the modernity and globalization of the world, the absence of local self-governance and meaningful citizen participation becomes frequent to a relevant degree as a result of "empty space" and disembedding.

As Syse writes, modern societies are characterized by public debate on "what good society is" and by a democratic form of governing (2009:55). In the climate of decision making by remote entities, even in democratic societies an absence of substantial form of citizen participation is prominent,

[20] It is also relevant to note that due to the modes of life and number of interactions we have daily, it is often impossible to have face-to-face encounters.

and citizens may feel precluded contributing with their vision of a good society. The local informants' attitudes where often reflecting similar situation in Svalbard, as many have impression that they are not participating in any satisfactory way in decisions that affect their lives, for example when it comes to nature use.

As Arnstein writes, public participation or the "citizen power" essentially means the redistribution of power, which enables those excluded from decisions to take part in the future. According to Arnstein, this is a cornerstone of democracy in theory, and no one is against it - in theory. However, in praxis without redistribution of power, participation can become an ineffective empty formality. Arnstein thus makes the fundamental distinction between the hollow "*ritual of participation*" and the actual power to influence the outcomes of decision making (1969:40). However, the power to influence decisions is not the only alternative as some people in Longyearbyen are asking for more moderate options, which will be discuss later.

4.4 Summary

The changes that have been taking place for the last three centuries in our society are all-encompassing. This chapter proposed a social theory of modernity as a useful tool in understanding the modes of life and the position of science in the society today. All aspects of social life are affected by these comprehensive changes which are classified by Giddens as time-space separation, disembedding of social systems (affecting the levels of public participation in political decisions) and reflexive appropriation of social relations through a continuous flow of new knowledge. With an aid of

Giddens' theory of modernity I will make an attempt to explain some of the phenomena closely defining the contemporary science-society relation.

5. Down the Rabbit-Hole of science articulation

Science is an enterprise that entangles a myriad of benefits and drawbacks, motives and interests, gathering representatives from all social domains while having a very diverse audience. This makes challenges of conveying scientific knowledge ample. Since science articulation depends on individuals and has no established working frame of standards and criteria, both those who might try to convey science and those who may try to understand it regularly meet difficulties. This chapter will provide an overview of the main challenges scientists and local people identified within the articulation of science in general, with some of it referring to the more particular subject of the environmental science. I do have to point out though that the division between challenges within articulation of science is somewhat artificial, as these aspects inevitably intertwine and overlap at times.

In the process of discovering what is behind the relation between science and society, the phenomenon was becoming curiouser and curiouser. The experience of unraveling this topic can feel like falling down that rabbit-hole, where just as one thinks the adventure ends, another one begins. So, let me commence the unraveling from the very start, explaining why anyone would embark upon such undertaking as articulation of scientific knowledge.

5.1 Why bother?

The first question that seems to impose itself from the start is why to put work and time into explaining science to anyone. Many different arguments have been listed in support of 'bothering' to convey science to the public.

First, there are authors that see intellectual benefits of articulating science, in a form of educating and cultivating the mind of non scientists, and thus contributing to intellectual culture itself (Thomas and Durant 1987:7). As one UNIS informant sees it, it is essential to provide knowledge to anyone who seeks it, even without any practical goal in mind beside a genuine appetite for knowing as a goal in itself:

> "Science communication is not just pursuing an agenda, and seeking a constituency for that. It is also about meeting a need and a desire in the elements of population for information about things."

Beside meeting the desire to know more, individuals also benefit from understanding science by becoming "*able to negotiate their way more effectively through the social world, [as] they are better equipped to make decisions*" (Thomas and Durant 1987: 5) and many everyday decisions we have to base on scientific data that we possess or have access to.

Some authors see conveying knowledge as a duty of those working within science. Myhr and Traavik state that enabling accessibility of the research to the general public is a moral and social obligation of science workers (2002:81). Durant et al. believe that the public support of research needs to imply a minimal level of understanding of that research (1992:163), i.e. academia has a duty to provide the possibility of becoming familiar with the content of the research enabled through public financing. This would allow the public to subsequently debate, criticize and utilize knowledge.

When it comes to public decision debate, democratic values are also in question if citizens are expected to support decisions without the comprehension of the essential facts that these decisions are based on, or are prevented even to participate on the grounds of insufficient knowledge.

It is thus imperative in democratic societies that debates enable citizen participation (ibid.; Maillé et al. 2010:70) and the functioning of democratic principles is highly dependent on public literacy or which, due to pervasive nature of science and its application in society today, scientific literacy appears essential (Durant et al. 1992:164).

According to Thomas and Durant, democratic governments benefit in return from an informed public which makes decision making more effective (1987:5). The authors also note that science itself benefits through expansion of the scientific knowledge, as the support of science depends to a certain degree on levels of public awareness and comprehension of it. Moreover, national economies as well as national power and influence depend and profit from having a certain number of professionals working within science and technology (1987:3-4) and the Third Report is attesting how public understanding of science can be largely beneficial as a major element in promoting national prosperity (2000: Ch.1. §1.10.).

Indeed, there are reasons of more a personal nature - funding opportunities for the scientists and visibility are increased if the research project is linked to a larger public issue (Zehr, 2000:93) and therefore communicating the research brings exposure, attention and money.

Speaking of environmental science, the articulation of research to the public is largely motivated by hope that this will result in engagement in mitigating environmental adversities, thus as one of the UNIS researchers noted "*one has a goal and a demographic target*". Communication of environmental issues is thus somewhat framed, since it can have an aim to mobilize people and reduce environmental degradation.

In extreme cases, having some kind of knowledge of science can be a matter of life and death - misunderstandings of science, notes the Third Report, can

have fatal consequences (2000: Ch.1. §1.13). In case of Svalbard and both seasonal and climate changes, it can be an advantage to understand how this is manifested in nature, thus avoiding accidents, which have been known to have happened on the island. My UNIS informant notices:

> "The more you know, the more respect you have [for nature]. Or just knowing when you are not supposed to drive a snowmobile on fjord ice and knowing that the weather can change suddenly."

In general, the ramifications of lack or misunderstanding of scientific knowledge can be diverse, for example persistent use of antibiotics by patients and farmers, or overdosing on vitamins due to the superficial comprehension of their effects (ibid. §1.13) or, as in case of Svalbard, outdoor accidents that at times end up in death.

Not communicating scientific work can create to an aura of obscurity and intensify skepticism. The effect can be disengagement from knowledge, and is expressed in words of Ingrid, my local informant:

> "I think it's crazy that the same scientist is coming here for 20 years and counting the reindeer, and gets so much money to do it. Just to see how the population of reindeers is …you know. Also I see that people are counting mice here in Svalbard. Of course, it might be interesting, but I don't see why they should get so much money to count mice."

This resigned attitude results from scientists not 'bothering' to bring the knowledge closer or perhaps an impression of researchers not disclosing knowledge on purpose, which will be discussed more in detail in the next chapter. Some locals in Svalbard display this attitude, as all of the research happens practically right outside their house yet many do not know what

the research is about and why it matters. The question 'why are these scientists getting so much money, and what is it that they are using it for – counting mice?' is paradigmatic. For those not familiar with the possible relevance of the research, what scientists do makes no sense and it might seem like a waste of time. In addition, scientists are, in this quote, portrayed as wasteful with money, spending it on work that no one knows purpose of. This way of seeing science likely contributes to lack of support and disinterest in scientific knowledge.

After discussing the incentives, it is relevant to mention some of the reasons scientists would not engage in conveying their knowledge to lay people. Like in any other profession, the knowledge and the status that work gives can lead to an intellectual and social stratification - UNIS informant answers:

> "Some scientists are snobs. They see themselves in a way that they think – I'm above this. I shouldn't have to spend my time or my effort doing this to this group of people who don't know and don't care, and won't understand and so…I don't want to bother with this".

Thus, if lay people are perceived as if they cannot understand or do not care about science, it becomes easy for a scientist to not engage in conveying knowledge. In that way to not understand science to begin with is a dead end – according to this quote, one needs to know science first if one expects to be explained science further.

There are however other, well-intended reasons for not explaining science, as my informant continues:

> "Often, scientists avoid communicating to the public partly due to possibility of telling something wrong, or being misunderstood, or alarming people and making them worried."

These reasons are often present where the findings are somehow linked to a broader cultural and political situation. As the ramifications of increased awareness and knowledge can be plentiful, a personal judgment might lead to leaving out the articulation of the results. In a specific case of environmental pollution in Hudson Bay (Canadian territory Nunavut), that this UNIS researcher worked with, presenting the results and their effect on the local Inuit community was evaded. According to my informant, scientists were not able to suggest any possible solution as this would entail involvement in many other social spheres, from internal state politics and ethnic minority issues to Inuit cultural practices and traditions. The population was thus left uninformed of the environmental status of the area they reside in.

Then again, there is a category of 'time', which emerged as substantial within the topic of why to bother to convey science. Time is here framed by a maze of relations and tasks within the academic *milieu*. Even though many recognize and acknowledge the significance of conveying knowledge, those who do want to venture into the escapades of science communication simply might not have time for it. Besides the everyday tasks as a part of scientific work, researchers are under additional pressure from their universities to bring in grant money, and everything that does not produce revenue suffers, including teaching. Another UNIS researcher reflects over this issue:

> "Although the attention is paid to the quality of teaching, because it doesn't earn the universities as much money, as a big research grant does, the emphasis is going more and more on researching.

> So teaching already gets a raw deal. People are primarily interested in their research careers. And the professional rewards, in terms of promotions and so on, arise from research. And so, the public outreach is even further down on the scale. And although I think it would be very desirable for scientists to have much greater awareness of our responsibilities as public servants, to communicate what we know about the world to broader public, one cannot realistically think of adding that function on to the existing range of responsibilities. So in order to increase here, you have to decrease on other stuff. I don't think there is any sense at all of scientists being public servants, people that are paid by the society to perform a particular function, to bring the money so they can balance the budget of the university."

What researchers do not have to do, they rather would not in order to focus on things which are expected, both beneficial for the researcher personally and for the research institution. As there could be conflicting interests within the academic system, scientists feel they are expected to meet all of these interests and having a very limited time schedule, they have to make a choice. As this informant points out, focusing mainly on the financial aspect works against both teaching and additional activities for the researchers, such as communal work. The dilemma of whether or not to engage in disclosing knowledge in a popular manner has to be seen, as this informant notes, as one element in a complex environment where the structure of academic society, university organization and other factors intertwine in the scientific *milieu*. Evidently, the expectations from scientists and the very organization of the academic system would need to be revised, in order to enable researchers to contribute more through the public outreach:

> "I think that the issue of communication of science is not a stand-alone issue, which you can fix just by addressing *it*, it's embedded within the system, which has rather deep seated issues, and to provide a balanced public service from working scientists, I think systemic issues within the university systems need to be looked at."

Systemic changes within the very organization of research institutions and their priorities appear essential in order to provide some room for conveying knowledge to the public. Nonetheless, even when choosing to explain one's own work, it is crucial to mind the choice of vernacular and the degree the concepts and meanings are shared to, as I am about to explain.

5.2 Lost in interpretation

Science speaks in mysterious words, says geneticist Richard Lewontin, and therefore no one except experts understands what scientists say and do (1991:8). Every domain of human creativity has its own language and unique vocabulary– a set of esoteric signs, which are used are symbols – intended to represent the meaning behind them. The actual meaning is not necessarily demonstrated explicitly, especially if those involved in the exchange imply the same meaning. Often they do not, thus the communication of science can become a hermeneutic problem - an interpretation of a meaning by those not accustomed to jargon within a certain sub culture may lead to the meaning being misinterpreted or lost.

Different language and dissimilar approaches can be a cause of miscommunication even between scientists themselves. The potential for misunderstandings can lead to experts avoiding to cooperate with those from other fields, as this UNIS researcher notes:

> "There is sometimes less communication than it should be between scientists from different disciplines working on the same thing. There are many initiatives to promote interdisciplinarity, but it is difficult because they speak a different language".

Nonetheless, all scientists still speak the language of science. What they see as a difference is something of an idiosyncrasy of dialects, between disciplines. As with dialects within a language, same words can have different meanings across disciplines, and some terminology is unfamiliar to those outside of a certain discipline.

However, not being trained in science at all and thus being unfamiliar with the language to begin with, separates a non scientist entirely from the communication that happens within the science. UNIS researchers see this problem as one of them put it, as being "*extremely important, but we simply speak a different language*". The difference in dialects between scientists is something that UNIS researchers acknowledge academia struggles with, as the researcher above noted – disciplines working together meet this kind of challenge frequently.

When it comes to scientists and public, there is a more of a substantial difference as these two groups use a considerably different vocabulary, thus, while speaking the same (native) language they, to an extent, speak a different one. This poses an obvious difficulty for researchers when it comes to attempts to pass scientific information on, outside of the academic circles.

These linguistic challenges are recognized by my local informants; for example it can be the choice of words that makes them stop listening. One local informant said that she would be attending the public lectures that

scientists hold "*if they talk a language that normal people would understand.*" Normal people, that is, non scientists are locked out once the scientific language becomes means of communication. One UNIS researcher recognizes the relevance of the word choice:

> "It is never simple enough, is what we learned. It's usually stupid things, like words scientists use – it can be one word, and it destroys it for people. It's normally the words, and not what you are trying to tell, what stops people [from listening]. You should be very simple with your language."

If one does not know the meaning behind terms used by science as these meanings are seldom, if ever explained to non-scientists, one is excluded from situations which are in fact aimed towards lay people. Thus, attending an event at which the aim is to disseminate knowledge but not being given a chance to understand, one might feel literally double crossed –by the mode of dissemination of knowledge and the intention of inclusion, as both can be perceived as ostensible. This feeling of being excluded, likely to contribute to growing disinterest in knowledge and trust in the scientific community, can extend into other areas of social life, an issue I will come back to later.

5.3 Make your science sexy

This section will discuss an issue summed by one UNIS researcher as *"we are having a lot of difficulty knowing **when** or **what** to try to explain to people, without losing them".* Making ones scientific work to sound appealing is, according to many of my UNIS informants, a form of art, or at least a desirable skill. Yet being a science worker does not grant this skill, so scientists "*need to have an ability to tell the story in an interesting way*" as one UNIS researcher notices. UNIS researchers unanimously expressed the

awareness of the importance of presenting science in an attractive way. This UNIS researcher, while noting she is aware of importance of her presentation, is still uncertain how to actually achieve it. As there is no handbook on articulation of knowledge, one has to try to manage on their own:

> "I'm not always that good at understanding myself how is that I can make my research interesting to the public. It can be difficult to present your research in an interesting and popular way. "

Many researchers see their work as *a priori* appealing so it is a matter of presenting interesting science in an equally interesting way, or as one UNIS researcher puts it:"*There is no boring science, there is only boring people*." Lay people, on the other hand, do not necessarily see the science as *a priori* interesting. When talking whether she finds research work at Svalbard interesting, Ingrid said: "*For them it's maybe interesting, that can be their whole life, but it is not interesting for us."* This attitude however does not reflect only a perception of science *per se*, but conveys a subtle resent towards the scientific community – this topic will be discussed in details in the next chapter.

Researchers I talked to see science workers as ones who need to actively work on inspiring the excitement about their work, as my UNIS informant notes: "*Of course, it is our responsibility as well to try to make our research a bit sexy. No one wants to read a boring story anyhow*."

So, how do researchers see a way to present science? As there is often a necessary choice between the simplicity and the scientific accuracy, some prefer to make their work more accessible, even if it is not entirely precise or correct. This UNIS researcher sees as most relevant getting people's

attention and appealing to the public, and at least at the start, by avoiding information overload and precision, that is at the expense of accuracy:

> "Maybe we shouldn't be so picky, even though I know people are not agreeing on that, and [they think] that you should manage to be both simple and accurate. For me, I think it's more important that you manage to make enthusiasm and make people interested, and put in corrections another time. Because you already have people's attention. I feel this is how media works now, to find a good person like David Attenborough. He is enthusiastic, or that Australian guy that was jumping on crocodiles. This creates interest and I think it is important. If you first manage to create interest, then you also continue and if people want more, you can be more and more accurate. I think that is the difficult step is to get people interested to learn more."

For many, nature history programs narrated by Attenborough are interesting and engaging. However, it is arguable how much science there is in these programs, and thus whether this way of talking about nature, although often capturing attention, is educational in terms of increasing scientific knowledge of the viewers. There is however no doubt, and I speak from my own experience, that it can be these kinds of programs which might make a viewer curious about science, but it is debatable whether they solely contribute to the increased interest in science.

However, not everyone believes that a simple amusing approach is better than an accurate scientific one. There are some who fear that conveying appealing, yet simplified stories is a wrong place to begin, as there is a danger of creating confusion, by simplifications, and this researcher believes that *"if you try to simplify the story you often tell it wrong. "*

The dilemma of whether and how to engage in popular presenting of scientific knowledge is about to be more defined in the future. As one UNIS informant explains, there is a growing tendency in US and Canadian universities to demand from scientists explanations, as early as in the proposals, how they are planning to popularize their work on the subject and what effect their research will have on the local or general public. These research proposal requirements still say nothing on the methods for popularizing science. This is still left to individual scientists to handle themselves.

5.4 What has this to do with me?

Relating the topic to the audience was identified by UNIS researchers as one of the greatest challenges for successful communication of science. Knowing *who* the public is and how the subject falls into the domain of their experience, interests and practices appears to be crucial. As notes earlier, there are many different publics (Featherstone et al. 2009:214, Turney 1996:1088), and thus a variety of types and amounts of knowledge, dissimilar or contrasting interests, attitudes and beliefs, there cannot be a uniform way of conveying scientific information. Speaking of environmental challenges, the role of the audience becomes crucial, as a significant part of the solution is seen to be in the hands of the public, relating the subject to the audience seems to be of even greater relevance.

In studying the audience and people's engagement and interest in science, and in an environmental situation in particular, it appears relevant to increase the awareness of and knowledge about the matter. However, there are findings which indicate that a mere increase of knowledge or awareness on the subject, particularly complex and seemingly remote ones such as an

environmental one, might not be enough to provoke a response in direction of change. Research done in the UK, on effects of campaigns organized by departments of Environment and Transport, attests that this belief is reasonable – campaigns managed to raise the awareness of the public, but at the same time failed to motivate action, leaving the public unwilling to engage, as there was a 5% rise in emissions from domestic consumption and 10% in emissions from transport between 1990 and 2005 (Ockwell et al. 2009:306, 309).

Some of the main difficulties of relating environmental problems to the audience are that the audience might not see how the topic matters to them, i.e. whether it is affecting *their* lives, how the knowledge can be used, what it is that an individual can do and essentially, how much of information released on this topic is in fact true.

As much as it is challenging to find a way to relate many scientific topics to the broad audience, when it comes to environmental matters, even if it might not always be more challenging, it seems more urgent. However, many disciplines and both basic and applied sciences face this challenge. The discoveries of basic sciences are often seen as less useful since they can provide more fundamental data about the world, which are seldom applied to everyday life and are thus un-relatable. One UNIS researcher sees as problematic the fact that science is often understood in terms of its usability and thus more relatable only if immediately utilizable. This notion is, as she notes, dominated by short-term thinking about an enterprise such as basic science, which needs time:

> "A lot of science revolves around – how you can use it. But in the basic research you often don't know how to use it until it's done, over a long period of time. That is hard for people understand."

The chains that individual scientific information build and where they end up and which discoveries they aid to is not always easy to trace, especially for a non scientists. For example knowledge on chemistry of natural gas is essential for technologies that use gas, but the importance of basic chemistry is not always obvious. As applied sciences draw their knowledge from basic research, the basic knowledge is thus crucial.

A challenge that environmental science meets is for example remoteness or invisibility of phenomena, as my UNIS informants say, which can have a significant role when it comes to relating it to everyday life. Some studied phenomena, despite being ubiquitous, appear remote from everyday activities and the present time. This UNIS researcher ponders how to relate phenomena remote in both time and space, such as climate change to people's lives and activities:

> "If it doesn't have a personal effect on you, then it's very hard to feel responsible. If you don't see the immediate effects, not before next 30 years…so that's very difficult question. "

She continues, examining whether relating this topic to people and managing to engage the public into acting, and putting attention on individual actions, means in fact having something to offer to them:

> "I do think people believe that the climate will change, but I also have a feeling it is very difficult to understand – what can I do which makes a difference. I guess if you really want to focus on how people should contribute maybe we also should focus not only on mechanisms [of climate change], but you have to take it down to what you as a person can do, it has to be simple and manageable."

In this way, as she sees it, people would feel they actually can influence the situation themselves, which according to my informant can work as an incentive for taking action. Some phenomena, such as certain types of pollution are not always detectable by senses, for example they are not visible such as in the case of pesticide or other chemical pollution, and also air pollution. Another UNIS researcher experience this in his work, and as he notes, these features of pollution make it un-relatable:

> "It is very difficult for people to understand things they cannot see. A lot of the work that we do is atmospheric and atmospheric contaminants. The air is the worst case because most of the times you can't see any of it."

In some cases however, the environmental problems are challenging to tackle despite of air pollution being so intense that it has a smell, and is even visible such as in Longyearbyen. Also, the matter of having ability and a chance to make a change and have an influence is however not only a challenge on a level of science articulation, but on a broader socio-political scale. I discuss this topic more in the Chapter 6.

Here, I see relevant mentioning another aspect contributing to environmental challenges being difficult to relate - the already mentioned fact that many local events are shaped by global ones. For example, the situation regarding pesticides in Svalbard is rather unfortunate. Although pesticides are not used in the Arctic, the chemicals common in agronomy in lower latitudes are brought to the Arctic by water and air masses that seasonally move between north and south. A lot of these chemicals are designed to be short-lived and destroyed by sunlight rather quickly. However, sunlight is absent from northern regions for long periods, so the

pesticides remain in the air and are then deposited by precipitation into the ground, water and ice (Ruggirello et al. 2010:2).

Many locals in Svalbard are aware of this kind of pollution, but the citizens appear unconcerned and unengaged. As the geographical position and the climate of the island makes it impossible to escape the pollutants from other regions, locals shrug shoulders as "pollution comes from everywhere" they say, and it seems beyond any one person's capacity or even of entire local community here, to alter the situation. The seeming indifference is caused by what Giddens calls "empty space" (1990:19) where as noted in Ch.4 the local circumstances are being shaped by remote or global events, which as such cannot be harnessed from a local position. Hence, being in a local setting one might see oneself as caught into a web of global affairs, feeling helpless to change anything and thus turning indifferent.

The climate issue is somewhat more complex than the pollution. Locals in Svalbard do not appear particularly concerned about the global climate change either. I asked what the climate change could be caused by, and Sofia, an informant replied: "*Hmmm, maybe it's the Gulf stream…or the ozone layer*". Both are however merely natural phenomena and not environmental problems *per se* (informant did not say – *change* of the Gulf stream course or *destruction* of the ozone layer). It was Sir Arthur C. Doyle's character Sherlock Holmes who stated that he did not know whether the Earth revolves around the Sun, or it is the other way around, because it makes no difference to his affairs. Quite similarly, the difference between Gulf Stream and ozone makes no difference to Sofia's affairs. This in return would mean that one who perceives things as irrelevant to their affairs is not likely to act in any way that would be altering the present state. Sofia's confusion is

perhaps a result of several factors, but the unskillful way of explaining these issues is possibly one of them and the difficulty of relating to environmental issues remains.

5.5 In the light of the available data

Lost accuracy is not necessarily only a *result* of simplifying or sexing science up. As presented earlier inconsistent data and inconclusive results are intrinsic features of science, and in this section I will present how my informants deal with those aspects when science is being conveyed.

Scientific knowledge is incomplete on some features of nature (Zehr, 2000:87), and since there is always more to find out, science can be described as one UNIS researcher did, as *"just a steady figuring out of how stuff works."* Another reason for incomplete and uncertain knowledge is already mentioned feature of modernity – reflexivity. Being dynamic and in a permanent state of discovery and re-appropriation due to input of new information, nothing in science is definite. With every new addition to the pool of knowledge, some of the previous confirmed information might no longer be valid, and the testing continues - in the words of Karl Popper - however long the theory stands the tests, it still does not mean it is verified (Stanford Encyclopedia of Philosophy 2009).

With expanded channels of communication and more information available each day, uncertainties of science are becoming more apparent than before. A popular and relatively one-sided view of science as a profession which is authoritative and trust producing (Zehr, 2000:88) can create a feeling of being misled once the uncertainties are revealed. UNIS researchers have an

impression that scientists are expected to make definite claims, as this informant notes:

> "I think the problem people have with science is that very few scientists will say – this is happening because of this. Particularly in the climate change."

For many people, science represents an enterprise which is producing absolute knowledge, and the image of science as indisputable is built from the very core of the cultural system – the education. According to Giddens, the science education approach in schools is teaching 'basic principles' or the indisputable facts, omitting to mention uncertainties and knowledge gaps. Giddens believes that, besides conveying the notion of science as absolute, this approach is serving a purpose of creating fundaments for an aura of respect and trust that surrounds the technical knowledge in general (1990:89). This notion will be discussed again in Chapter 6, since trust and obscurity that surround expert knowledge can also serve other purposes, as for example maintaining this notion and presenting scientific information as facts can be seen as exercising power.

It appears unrealistic to expect that lay people at all times realize and accept that scientists disagree or do not know everything – particularly in the light of the dogma of science being absolute knowledge-producing. The view that local people hold confirms to an extent the presence of these notions of scientific knowledge being consistent and permanent. Marte, my local informant explains her confusion regarding disagreements between scientists:

> "Scientists are like doctors. One doctor is saying this about the swine flu, and another is saying – no, that doesn't help. So it's also

> confusing. I think it's confusing for everyone, even for scientists it can be confusing. They can sit and fight together, because he thinks that the bird is behaving like this, and the other scientists also doing a research on the same bird, say – no, it's like this…it can be confusing for everyone."

To avoid such confusion, scientific statements can contain precautionary formulations, such as, 'as far as we know', 'there is scientific uncertainty around' or 'in the light of the evidence', conveying inconsistencies. The following one, for example, made by a UNIS researcher, articulates the uncertainty within the climate change research – How confident scientists are that the global change of climate in happening?

> "It is difficult to say. In biology I cannot show you any evidence of climate change. But that's not because it's not there, it's just that we cannot detect it from the natural variation."

The more information on science is released and available with the development of technology, the more often statements are formulated in this way. However, the confusion that Marte voiced above remains as – although the inconclusiveness is articulated, the reasons for inconclusive or indefinite results is seldom conveyed. For example, this UNIS researcher explained in the interview that science is approximate, often partly a guess:

> "Most scientists would never say that their theory is the whole truth. It's the best model we have that can predict what will happen in the future. That's what the model, the theory is. It predicts what might happen in the future, and it doesn't have to actually be correct."

However such statements are seldom or never heard in public speaking *about* science.

In attempt to avoid appearing categorical or dishonest, these formulations are guarding science workers and providing more realistic picture of the knowledge available at the moment. But the fact that science does not have to be correct and the reasons behind are obvious only to scientists. The resulting confusion can be particularly frustrating when one is expecting definite answers from science.

My UNIS informants voiced a necessity for more articulation of the inconclusiveness in the scientific research. Indeed, for this to be successful strategy, the inconsistencies would need to be addressed in terms of explaining why and how these are part of scientific inquiry and not only as existing as such.

5.6 Forest for the trees

Asked what he did if, when reading a scientific paper he comes across mathematical formulas, zoologist Sir Solly Zuckerman answered: "*I hum them.*" Scientists often cannot understand other scientists, says Richard Lewontin (1991:9); for example, biologists avoid reading mathematics in scientific papers. With growing specialization of science, and growing knowledge within each scientific discipline, it can be challenging even for experts in one discipline, to understand the phenomena explored by another. The fact that scientists find challenging to communicate with one another has diverse ramifications, indeed when it comes to conveying science to lay people, but also on science itself.

One might be surprised to find out that there are differences in values that different sciences, or better to say scientists, hold. A viewpoint of one scientist is not necessarily valued by another, as this UNIS puts it: *"What I might want to know from a scientist in another discipline may not be what this scientist thinks is important."* As noted earlier, scientists tend to think their understanding of realty is the right one (Norgaard and Lélé: 969) and thus, additional difficulty may be posed by disagreeing regarding what is worth researching or discussing, and moreover, what is worth preserving in nature, inevitably adding to challenges in the interdisciplinary approach of environmental science. Not being profoundly knowledgeable in all disciplines can mean that one is focusing or searching for knowledge on seemingly less relevant issues, although what a 'relevant issue' is can be highly subjective. In other cases, simply by being trained in a particular discipline, one may value more aspects that this discipline sees as principal. So what often happens is a situation where:

> "[w]hen engaging with their colleagues in other fields, scientists typically find that their colleagues define the problem quite differently or seek different types of answers." (Norgaard and Lélé (2005:976))

What this leads to is that when explaining the same subject, e.g. environmental issues, researchers from distinct disciplines focus on different aspects in nature, either as a result of their specializations or of the judgment. The divide between different disciplines also has ramifications in how nature is presented by science, and one UNIS researcher shares her concerns here:

> "I have an impression that people think we are not good enough to work together with other researchers. Sometimes I feel that if

> we talked more together, we would give a more complete picture [of nature]"

My UNIS informant is opening a highly significant issue here – different interpretations, evaluations and lack of cooperation culminate in a fragmented picture of the natural world that science gives. In a research conducted by Syse, on the conflict between use of land and conservation of landscape in Argyll, Scotland, after having a meeting with scientists, one farmer perceives expert knowledge on nature as disunited:

> "They've all got a bit – which they never tie up, which is no surprise! They've only been educated in one department (…) the weather…the environment and the animals and the birds and the plants… they can't tie all that together!" (2009:197)

Some 50 years ago, Rachel Carson made the exact same point, saying: "*This is an era of specialists, each of whom sees his own problem and is unaware of or intolerant of the larger frame into which it fits.*" (1962:29). Due to specialization of science and the use of technology which takes us to the molecular and atomic levels of nature, and perhaps some of the obstacles discussed here that prevent more unified studies of nature, the picture that science is presenting appears as a colorful collage, rather than a cohesive depiction of nature. This is likely what assist in the difficulty to link for example events in society to events in nature and to seemingly unrelated further changes in natural world, as the wholeness of the nature and its interconnectedness is lacking in the articulation.

As Richard Lewontin notes, science cannot be taken out of the socio-political and historical context. We live in times of atomistic thinking he says, and we see the world, not as Descartes figuratively puts it being *like* a clock, but

being a clock (1991: 14). We try to understand how the world works by understanding how it parts work. Lewontin however believes that nature cannot be understood by picking it apart, as one destroys the essence of it by doing so (1991:11). Studying nature in such way was depicted in words of Alexander Pope, being it "*like following life through creatures you dissect/you lose it in the moment you detect*." (1826, I, 36). By breaking nature into pieces, the understanding of the interdependence and unity of life in nature is lost.

5.7 The headline science

Science in the media is a broad phenomenon which deserves special attention since mass media represent one of, if not *the* biggest communicator of scientific information today. According to The Third report "*[o]nce they leave school, most people get most of their information about science from TV and the newspapers*" (2000: Ch.7. § 7.1.). Considering that means of today's mass media carry out the major part of science articulation, how the science is conveyed to and perceived by the public to a great extent depended on the perception and comprehension of science by any given popular medium.

Beside the issues of, as UNIS researchers see it, insufficient knowledge and misunderstanding of science, the topic choice and writing styles are affected by other goals such as popularity and profit. In this way, additional goals interfere with the one of informing, and the borders between information and entertainment get blurred as market forces, commercialization and commodification take over (Deuze 2005:861). This manifested itself in an attempt on the part of the media "*to give a simple and clear message*" as perceived by my UNIS informants, and scientists are disconcerted with

letting journalists evaluate which message is to be conveyed. "*Their judgment of what the message is quite often is not the message the scientists would like to communicate*" says one UNIS researcher.

Becoming a hot spot for science and the climate change Mecca, Svalbard is seeing profusion on the part of mass media as well. Scientists at UNIS view this rising interest with skepticism, in particular when encountering reporters that have, as researchers tell me, already made up their minds on what they are going to conclude, so the information scientists provide is used to support to story. Working in Svalbard, this UNIS researcher describes his experience with journalists:

> "We have two different types of journalists that come here on regular basis, those who are genuinely interested in finding and telling a story and those who just want support for the story they want to tell. They are looking for someone who will tell the dramatic story, even if that's not the whole or any of the truth."

Although there are media workers who aim to do justice to research (and UNIS researchers say this approach to journalism is what they would like to see more), my informants see the other kind as dominating. Scientists believe that the press, being after sensational stories, is presenting science and nature inaccurately. According to Friedman et al. there is a disagreement between scientists and science journalists, not on whether accuracy matters, but what it is that comprises accuracy (1986:104). However my UNIS informants view media portrayal of science as a neglect of accuracy, as being accurate is not something that really matters for the media. When talking about this subject, my UNIS informants perceive a tendency to portray scientific results as definite, conclusive and absolute. Some scientists see this as omitted accuracy: as uncertainty, indefinite

results and relativity are excluded, and as mentioned earlier some researchers I spoke to believe it is relevant to convey the inconsistencies within science.

Dramatization of how science presents nature is seen by researchers as an attention-seeking gambit, re-shaping the reality to fit the one suited for reporting and adding to a distorted portrayal of the natural world. The inclination to focus on some features of nature while omitting others some scientists see as creating a imbalanced picture, as more spectacular and controversial aspects tend to get disproportionate level of coverage, since as one UNIS informant said, "*a lot of science is not controversial, so it doesn't make headlines*." This impression corresponds to findings by Friedman et al., who also note that there is a discrepancy between the reality and media depiction leading to an out of balance portrait (1986:106). This can bring public attention to subjects of marginal importance – as in the case of the polar bear. While a significant part of public attention, and thus resources as well, revolve around saving the polar bear, whose importance is overstated by the media, UNIS biologists note that in terms of ecosystem stability, polar bears are irrelevant. Nonetheless, the medial focus on these animals contributes to the impression of the preservation of polar bears as critical for the stability of the polar ecosystems. The focus on the preservation of certain species is not an issue stemming solely from the approach by the press, and I will discuss in Ch.6 how there are many more aspects that add to this issue.

To depict dramatization of nature on the part of media, one UNIS informant compared his impressions when watching a television version of arctic nature, with having experienced the *actual* nature in the Arctic:

> "People watching documentaries on climate change, and everything is condensed and you have pictures of front falling of the glacier, and polar bear standing on an iceberg, and doomy kind of voice over talking about what is happening to the arctic world…But look right there and there is a magnificent landscape, absolutely gorgeous, which can kill you, it has a lot of different flavors, and it's a live and vibrant and there are animals there … and ok, human activities continue to influence this system in some ways, but it's not as its portrayed, the actual experience of being out in this environment is rather different."

Having visited Svalbard myself, the actual experience *is* quite different. The tendency of melodramatic representation of nature is both exaggeration and simplification; standing on the cliffs of Svalbard mountains one can hear the silence broken by the cry of birds rather than of sounds of a symphonic orchestra. I have not seen a glacier front falling off once, although there is no doubt that this at times happens here. The "condensation" of events, where striking images of crumbling nature succeed one another, with a theatrical effects of a Stravinsky piece played in the background, gives an exaggerated and simplified portrayal of nature.

Attempts by the popular media to try to catch everyone's attention through drama and simplicity, called "dumbing down" by some UNIS researchers, is making a sort of a melting pot out of science news that would please everyone's taste. This is seen by one UNIS informant as underestimating the public ability to comprehend nature as it is, as complexity of the natural world might be 'too much' for people to grasp:

> "A great deal of science reporting is a cartoon and cartoon is a medium for catching people's attention. It's a sketch that

> exaggerates some features, and ignores others. Even though we live in times where information is easier than ever before to communicate, despite that, it's still just a cartoon. There is an idea of what the public can deal with. But actually, there is a very large constituency of concerned people who are being shortchanged by the media, by trying to capture everybody."

And 'trying to capture everybody' can thus result in the creation of a simplified image of nature and, consequently, the creation of corresponding public perception of it. For example, as UNIS researchers say, while majority of glaciers in almost all parts of the world are indeed shrinking, these problems have been magnified beyond reasonable limits by the media, up to the point where shrinking of glaciers is seen as a cataclysmic event. As this UNIS researcher concludes: "*The reality is lost*."

This attempt to sell a product to as many people and catch everybody can end up in only superficially and temporarily getting attention, making science appear as entertainment, something to kill time with. As information became symbolic tokens with modernity, which are "*passed around without regard to the specific characteristics of individuals or groups that handle them*" (Giddens 1990:22-23), information on science becomes just information, like any other. In the case of mediating science via broadcasting services, generic information intended for everyone is reaching a variety of individuals and groups. Not being specifically addressed to any group, it usually omits to catch anyone's attention or address their interests for any substantial period of time to generate actual enthusiasm and sense of importance.

There is also a problem of repetitiveness in the medial reporting, and UNIS informants are concerned with the danger of the tendency to reduce science reporting to repetition of initially striking images*. "It is always the same footage"* scientists say, as there is more to tell about environmental science than perpetual use of collapsing iceberg images, or dismal looking polar bears floating on a block of ice. There is a risk, as put by UNIS researchers, of "*people just getting tired of it and switching off*". Media space saturated with the same images might be undermining the goal that for example environmental science is trying to achieve, as the powerful effect is continuously exhausted and the attention is no longer maintained. In spite of the attempt to keep people's attention by dramatic portrayals and a theatrical atmosphere surrounding, for example, climate change in the media, the overexposure is ending in reduced interest. This is known as a numbing feeling, boredom – the widespread awareness of generalized risks among the population that by being bombarded by these warnings, lets them become part of a background noise (Giddens, 1990:127-128). The overexposure to the same information might have indeed added to indifference in society, making the outreach by science ever more difficult. Since news must be *new* every time, novelty is increasingly challenging to achieve; environmental questions have been in the news for a while but the strength of their ability to reach an audience is watered down.

It is certainly unfair to blame exclusively the journalists. Shuchman et al. (2001) notes that scientists, while have an understandable desire for publicity, in terms of getting funding, prestige for the institution and increased awareness of their research, invite the press to conferences without explaining essential scientific concepts or providing a context for

the research. This leaves reporters to find omitted information themselves, a situation unfortunate for all sides participating in science communication.

Scientists are of impression that it is the media and not the academic world that is determining what is written and how, and one UNIS informant explains why this is indeed the case:

> "I would guess that for most scientists, the main contact with the world is when a journalist phones you up and is looking for particular information, but it's solicited by the media people, and they are making the decision how the whole thing is pitched...rather than me deciding 'we need something about this' and actively seeking an outlet. It's usually the other way around."

This UNIS researcher does not see as surprising that the scientists can often turn out discontent with how science is presented, considering the fact that scientific stories are published more often than not on initiative on the part of the media, where scientists are there just to provide a backup to the story already set. This could perhaps change once the scientists start seeking its audience, instead of leaving the media to seek the story.

5.8 Education

Until 1983 UNESCO'S 'Science for all' initiative put school science in focus, the goal for teaching science in school was simply a training of future scientists (Fensham and Harlen, 1999:755). I previously noted that there is a certain consensus among scientists, that for having confidence and achieving comprehension of science, it appears that understanding what science does and how, i.e. the way science works, is more relevant than learning actual

facts. But this way of teaching *about* science, as this UNIS scientist explains, is virtually absent from schools:

> "We are not even beginning to teach children [about science] at an early age, and I think if we did that it would be easier, for at least some people to understand science when a scientist wants to talk about what we do."

The awareness of the effects of early science teaching has been pervasive in my conversations with scientists. According to my informants, in order to successfully communicate some of the more complex issues within science, those more basic topics are preferably already explained and adopted into the body of knowledge an individual holds. Some of the difficulties in the process of transmitting and understanding scientific knowledge, that conversations with UNIS scientists revealed, point to a need for a fundamental change in the way science is taught.

Important aspect within teaching for example on complex and interdisciplinary sciences, such as for example the environmental science, is that oftentimes school teachers are uncertain themselves about what to teach and how, and essentially – what is what. One of the UNIS informants has been previously working in re-education of high-school teachers on *how* to teach environmental chemistry. What was of concern was the actual lack of thorough understanding of some of the topics communicated in classes. In working with these high-school teachers, my informant encountered situations where teachers display lack of understanding of their subject:

> "Global warming, ozone layer and acid rain are all the same thing. They can't distinguish these things. They tend to teach these issues as it is all the same, the problem is the same and the source

> is the same. This really becomes the problem because the children that are taught these things then get confused."

The Third Report confirms this claim, by stating that most school science is taught by teachers "*with few science qualifications or none at all*." (2000: Ch.6, § 6.4.). When those who are teaching do not understand the subject, what level of understanding can be expected from those who are learning? Eventually, the confusion and lack of understanding is passed on and reflected in society at large. The tendency to mix ozone layer with the Gulf stream might be a result of disengagement from the subject since it may not matter to an individual, but it can also be at least in part a result of the fact that outside scientific community (and sometimes not even within) these phenomena are not clearly defined or familiar. The change of climate might be something that has gotten attention fairly recently and many have not quite grasped the phenomenon yet. Nevertheless many other environmental problems we face today have been present for almost half of century.

As it was repeatedly said in interviews with UNIS staff, the critical problem appears to be that people do not understand *how* science works. This is also pronounced in the Third Report which states that the 'understanding of science' is, rather than obtaining extensive knowledge on different fields of scientific, being familiar with the method, research advances as well as implications is what is crucial (Ch.3, §3.1).

Understanding how science works and negotiating one's way through the society loaded with information and conflicting interests, entails according to one UNIS informant a decisive aspect – critical thinking:

> "There is a lack of critical thinking I think, among people. They believe something without ever really thinking about it - they

> don't really question it. It is interesting how many people would read something on the internet, and because it's on internet – it is true."

And though it might be easier to simply take information for granted, it may also be impossible not to - if the basic education appears to be lacking enough encouragement and promotion of critical thinking. Erich Fromm noticed that from the very beginning of education original thinking is being inhibited, and people's heads are filled with already made thoughts. One of the main reasons is, according to Fromm a belief that the mere increase of facts is the road to knowing the reality. In this ways thinking becomes a "machine" for registering facts (1989: 172-173). Collecting facts instead of thinking thus excludes critical judgment.

This UNIS researcher sees importance is critical thinking as subjecting virtually every information to scrutiny, including scientific claims:

> "Even a scientific article is being reviewed by two external people and it's published. Just because it's published, it doesn't make it true. There is a need for people to think critically, the more people think critically the better."

Indeed, in the light of previously explained uncertainty and fallibility of any scientific claim, being published as my informant notes, does not grant it being actually correct. Subjecting any information including a scientific statement to scrutiny does not mean classifying it as *a priori* false. Thinking critically by scrutinizing a piece of information would thus mean not taking any information as evident. The issue of modern means of communication can be seen as quite a challenge here if modern education is not up to date. While providing a world of choices and possibilities for obtaining knowledge

on almost anything, learning to discriminate between a plethora of different (sometimes seemingly the same) information and to subject it to critical reflection is oftentimes simply omitted from education, yet for understanding science it appears to be paramount.

The lack of practicing and encouragement of critical thinking can be explained further in many ways. There could be psychological reasons – for some it might be easier to be told what the truth is and thus avoid responsibility of evaluating and making choices oneself. Insufficient encouragement of critical thinking in culture at large perhaps is also influenced by more malevolent interests, e.g. for maintaining political *status quo* as critical public is more difficult to manipulate and manage, or reasons stemming from a structure of the education system, which are perhaps not corresponding to the reality in which people would exercise obtained knowledge.

The root for the lack of critical thinking may also lie partly in already discussed trust in expert knowledge. This trust in abstract systems is a part of day-to-day life, since being part of a modern society entails that basing majority of our actions on this kind of trust, i.e. "*the nature of modern institutions is deeply bound up with the mechanism of trust in the abstract system, especially in the expert system*." (Giddens 1990:83). This in practice means that we trust that the house we sit in will not collapse, owing to the knowledge of the builders and that if scientists tell us something, they know what they are talking about and thus re-examining is unnecessary. Another observation previously mentioned is relevant here. It is namely at school we receive our first general ideas about science. We are taught from an early age that science operates on indisputable facts, principles and axioms. According to Giddens only those few that pursue an education in science are

to be introduced with uncertainties, controversies and potential fallibility of all scientific claims. This, as the author explains, has its reasons in the fact that such approach ensures implanting and sustaining the respect that most people have for expert knowledge. Otherwise, with much more insight into mistakes and uncertainties that experts negotiate, holding science in high regard would be significantly undermined (Giddens, 1990:89).

As this trust starts to dissolve, before the outpouring of information via different forms of media, it appears crucial to find more appropriate ways to enable successful communication of scientific knowledge, that is part of our lives and relevant regarding understanding the world around us, reducing possibility for manipulation and making more sound decisions. One UNIS researcher suggests the domain where it appears vital to act:

> "Oh, it's got to be education, to teach people to think critically. People believe things because that's what they were taught when they were young. I think the important thing about science is, you've got to teach people basic facts of course. But you've got also to teach them the way of thinking, which is to think critically, not just to accept the fact. If somebody tells you something, ask your self is this making sense and if there is a reason why they are telling me that. "

Thinking critically is as this UNIS researcher sees it, not something reserved only for the elite, or those who want to pursue careers in research. Enabling one to think critically, instead continuing to provide a fertile ground for confusion, resignation or even indoctrination, means enabling an individual to use reasonable judgment, to evaluate what the reality is and how to find a way through the world. It would however also have an substantial effect on

the immaculate aura that used to (and still to a great degree still does) surround science.

5.9 Final comments

This chapter identified some of the barriers that stand in the way of a more articulate science, and as such it addressed the first objective of the thesis – reflecting over attitudes of science workers and lay people when it comes the verbalization of the scientific knowledge and a transfer of this knowledge to those outside of the specific knowledge-producing circles.

As presented in this chapter, there is no agreement within the academia whether the articulation of science is an imperative in any given case. As there are both benefits and drawbacks of this endeavor, the final decision is in most cases still left to individual science workers to make, on whether and how to carry the articulation out.

Provided that researchers decide to convey the knowledge they have – they will meet numerous obstacles in doing so. The very language of science has become highly specialized over time that, without additional explanation of terminology the communication turns challenging, even among experts. The choice of terms is not the end of lexical troubles; the way the topic is presented plays a part, and as in every other activity, people within academia differ in their ability to make science sound engaging. In addition, there is still not a consensus whether it is more relevant that science is appealing and amusing and thus simplified, or more educational and hence presented in its complexity.

As discussed in this chapter, sciences in general and environmental science in particular are struggling to find a way to relate the topics to lay people. Scientists recognize that it is crucial to impel people to act upon warnings on critical environmental situation; how to achieve this is however unanswered.

Furthermore, science as an enterprise which, as one UNIS informant noted, is "figuring how stuff work" does not have all the answers about the world, yet it is perceived as such by those outside of academia. Partly perhaps because, as Giddens notes, we are thought from early age that science is immaculate, it is often overseen that immanent to scientific investigation are uncertainties, inconsistencies and unknown aspects. It is therefore that contesting statements from different scientists, or from same scientists at different times appear as disingenuous and science and its workers as untrustworthy, as the necessity of scientific results is seldom explained to people.

Furthermore, specialization and expertise in science, as well as lack of understanding and cooperation between different disciplines seem to be creating a fragmented picture of the natural world. The result of such portrayal is that for lay people, and even for scientists, it becomes difficult to connect causes and consequences of the events that take place and which science is investigating.

The way science is presented by media is seen by academia as over-dramatized and exaggerated and science journalism as dilettantism. Researchers are for the most part, discontent with the way journalists report on science, nonetheless science reporting is left to the media, and

it is still a rare event that experts would engage in presenting the knowledge in media themselves.

Finally, the matter of education seems to be encompassing. It is in school where we first start having inaccurate impressions of what science is and how it works, and this impressions are taken into an adult life, where most people, with exception of those who continue to work in science, keep distorted idea of science which affects their attitudes and behavior. It is in school education that the critical and original thinking instead of being nurtured, is in fact being smothered.

6. At the final frontier?

This thesis was envisioned as an endeavor which would locate difficulties within the strained relationship between the science and society, since the starting premise was that improved communication of knowledge is desirable and necessary. Over the course of my exploration and writing, I have stumbled upon some unforeseen aspects of this relation, and thus extended the original intention of focusing mainly on mechanisms of science articulation improvement. This chapter is thus proposing another aspect of science in society which is fundamentally linked to Giddens' understanding of *trust in expert systems*. This aspect is complementary to advancement of knowledge articulation and critical for overall improvement of the science-society relation.

After a long way down the hole, thinking that getting to the bottom is where it all ends a new landscape of events appears; at the end of the hole there was an entrance to a new world of adventures. The process of working on this thesis had a similar effect as being in the Wonderland – in order to go further I had to dwindle, or stretch or change some of my own understandings of the world. As it turns out, no frontier has to be the final one.

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This chapter will examine the science-society relation from a local social and political context, through investigation of what constitutes trust relation between experts and local people, while exploring the local life, practices,

and a relation to nature that that people in Svalbard have. In addition, the effects of scientific applications on people and nature as well as the changes of perception of nature that science assists to will be discussed as well.

Our concepts of the world are driven by yearnings for order and purpose (Glacken 1967:3), and studies of nature can be understood as one of our most ambitious endeavors to find order and purpose in the natural world. Nature has many different meanings for humanity; we have not come up with purpose and meaning of it which is shared.

If among best proofs that one has stepped into the sublime landscape is the emotions that are provoked (Cronon: 1996:73), Svalbard can be the epitome of the sublime[21]. One glance over the cliffs and the bay that Longyearbyen lies in is breathtaking. Gazing at the horizon and reflection of the sun on ice and snow, being surrounded by formidable scenery carved by the glaciers, facilitates recognition of one having an incomparable experience and a sense of timelessness - millions of years weaved into the frozen grounds and ice attire of this island. The allure of nature here, in its simplicity and yet formidable beauty, moves, threatens and inspires. The nature in Svalbard is honest in its seduction - it does not lure with pretence of harmlessness. It is staring silently, creating an aura of danger and an ambience of eternity. It is thus no wonder that the majestic nature in Svalbard is a subject of awe and pride, and that inspires so many conflicting feelings – yearn to experience it and urge to defend it, a strive to exploit and desire to protect it.

[21] The notion of sublimity comes to prominence with the Romantic movement, I use it here as it is used in philosophy, where it is explained in aesthetic terms. For example – for Edmund Burke, sublime is what inspires astonishment (1767:96), and for Immanuel Kant, sublime is "the name given to what is absolutely great" (1790/2008:71). William Cronon uses it for landscapes which inspire terror and awe (1996:69-90).

Doing fieldwork in the Arctic provided me with an outstanding opportunity; Svalbard is a place like no other. Its specific geographical position resulting in relatively mild climate made this archipelago an intersection in polar journeys, as it has been a destination for exploration, adventure, research and industry - it is one of the most accessible polar locations. People from around the world are flying to the north, for professional and personal reasons. In the last 20 years, the interest for the Arctic environment has grown dramatically - science, tourism and adventure seeking in the North Polar Region has flourished. The accessibility of the Arctic increased rapidly in recent decades, due to the technological development of transportation to and at the site, and navigation opportunities through the surroundings. Researchers hope that the Arctic will give answers to those questions left unanswered in other areas. Many stop by here as tourists, while others seek thrill, enjoyment and adventure in this place, one of the very few considered untouched, as the remoteness and the unknowns here constitute an idea of an enigmatic ambiance and provide an occasion to marvel. The opportunity to be at a unique place that so few visit may create a sense that this experience is enriching the identity with authenticity. Many of those who are here to stay have turned the unique experience of Arctic into a lifestyle, and some of those opportunities that Svalbard provides such as the nature experience, are for many an essential part of the life here. However, with increasing official efforts to put wilderness areas of the archipelago under protection, these unique opportunities are being conditioned by the authorities, or even prohibited, causing a conflict.

Small community in Svalbard can be seen as a fusion of tradition and modernity, wild and modern, with the wilderness around the corner, hi tech life, modern institutions and science, it is also a paradigm of the relation

between science and society. This chapter will explore the forces that clash at this arctic island, where the local conflict between scientific community and residents revolves around the use of wilderness.

6.1 The dialectics of wilderness

This section will examine the concept of wilderness; before proceeding into some of the collision that take place in Svalbard, it is relevant to grasp the revisions that ideas of wilderness went through and where it is today.

Wilderness and our understanding of it have gone through transformations, and consequently our relation to it has changed along the way. Before there was even a notion of wilderness, it was humans who were wilderness, and until the birth of civilization, i.e. the establishment of agricultural practices in Middle East, there was no distinction between humans and nature (Foreman in Cronon, 1996:83). In the first polytheistic religions, such as e.g. the religion of ancient Greece, the wilderness was considered sacred - a refuge of deities, a place forbidden to exploit; even using a grove for leisure might provoke fury of the immortals (Coates 1998: 31).

As environmental historian William Cronon writes, with the early Christianity, and all up till the end of the 19th century, the idea of wilderness was a synonym for deserted, savage and barren, on the edge of civilization and morality. By the turn of the century, the notion however became its antithesis; once in contrast to order and goodness, it suddenly became something of a paradise and he search for the wilderness began (1996:71 - 72). *"No description of Heaven that I have ever heard or read of seems half so fine"* wrote John Muir upon his visit to Sierra Nevada (1911/2006: Ch.3, part 3), and with the rise of Romanticism - the transatlantic endeavor for wild

nature preservation, the notion of wilderness became sacred once again, and much like in the ancient pagan tradition the wild nature became a place where one encounters a chance "*to glimpse the face of God*", an antidote to refined civilization (Cronon 1996:76) and a remedy to a complete surrender to materialism (Worster 2008 webpage).

The majestic landscapes were experienced as awe and terror inspiring, and with Romanticism thus the term *sublime* came into prominence. Seeking this breathtaking experience within the inanimate beauty of nature, as Cronon understands it, had a purpose and an effect of reminding of oneself of own mortality (1996:73), by casting a different light on the meaning of being. The feeling of awe may take away evanescent mundane worries, as they fade before the powerful timeless landscapes. The desire to question one's own purpose is perhaps immanent to the human condition, and the magnificence of wilderness seems to be, for some, one of the most compelling experiences that can instill one to ponder.

With the late Romanticism and onward and the increase of tourist visits to natural wonders, the feeling of terror and worship that the landscape used to inspire was replaced with more moderate sentiment, due to the "domestication" of this striking effect (Cronon, 1996:75). At the same time, with the technological development, a devaluation of the wilderness was occurring, as it is easily reached by the modern means of transportation, and as the mass exploitation of the wilderness' aesthetics grows. Today one can see awe inspiring scenery everywhere - on postcards and desktop backgrounds, posters or television – upon arrival to the actual destination, the stunning effect of the landscape reproduced on a restaurant tray may be diminished, and the wilderness is marketed to the point of sublimity being reproduced in a form of kitsch.

Today many see the sacred places of intact divine nature as just as much an admonition as much as a relic of a disintegrating natural world; preserving wilderness as an awesome object of adoration is of less importance. And while the wild nature can still be seen as a source of inspiration and worship, a frontier and the refuge from urban life, the urgency for reducing the impact made on nature has less to do with piety and apparently more with the realization that our modes of modern life conduct are in question and that the prospect of our life practices is becoming uncertain. The wilderness is vanishing rapidly and not even the most remote and hidden places are spared. All around the world, initiatives for preservation of wilderness are emerging. However, why we preserve it and what it is today, are still a multiple answer questions. Some no longer believe we can find wilderness that is spared of human impact, as Katherine Hayles puts it - if Yosemite National Park is wilderness, then *"wilderness is synonymous with human intervention, for only human intervention has kept Yosemite as a nature preserve"* (1996:410).

Changes in the perception of nature bring changes in relating and using the nature. As Spirn writes, between 1860s and 1960s, the changes in ideas of the wild have brought with them changes in understanding what we should do with the wild, as in the case of Niagara falls improvement project – where the suggestions for improvement were changing over time as the notions of wilderness change (1996:95-99). It is thus of relevance to examine our ideas of nature in order to understand the ways we relate to it.

6.2 The Hitchhiker's Guide to Svalbard

Svalbard is a site where the conveniences of modern life is fused with what is still classified as wild nature, creating one of the few, if not only easily accessible places in the Arctic where society fuses these two extreme features in a seemingly harmonic synthesis. Life is here mainly concentrated in small town Longyearbyen[22], and extended into areas of wilderness outside the town.

Life in Svalbard is an alloy of contradictions, for example the government, both local and national is increasing the limitations of access to nature, the mining industry is present and operating in the island, and an eruption of tourism which started with the opening of the airport in 1975, is not subsiding. It is a place where small town attributes intertwine with the features of a global space, and where a fully modernized society is searching for the wild.

Observing the local life in Svalbard, at first sight one can be stunned by these contradictions that comprise life and practices in the island. Only coming closer, and re-examining conventions and beliefs taken for evident, this place starts to reveal the hidden significance of seemingly contradicting properties. I will start by describing Svalbard and present some of the features of life here.

[22] There are other towns in Svalbard, Barentsburg which is a Russian settlement and Ny-Ålesund which is a research area. Longyearbyen is by far the most populated, with 2040 inhabitants, in contrast to some 500 in Barentsburg which consists mainly of Russian mine workers and their families. My research results are based on information I collected in Longyearbyen.

Life at the edge of the world

Longyearbyen is a small town surrounded by hills, and at the time of my visits everything was completely covered with snow. The area would appear entirely silver and white, if not for an explosion of colors that the houses in the town are painted in - a rainbow on the sterling background.

At the time of my first visit, I made an *entrée* into the polar night, the sun did not bother to rise and the town was twinkling in the blue winter moonlight. The second time I arrived, I was greeted with the most blindsiding reflection of the sunrays in the ice glaze, luminous gold poured over the whole town and its surrounding. Only weeks after my second departure, Longyearbyen was already entering the period of white nights – night-time flooded with sunlight was on its way. These peculiarities characteristic of high latitudes can inspire a thought process, which would last long after I left Svalbard - pondering ideas often left unquestioned, first of them being the one of occurrences of light and darkness as necessarily corresponding with the conventional ideas of day and night.

When winds come to the town every once in a while, brushing the snow away and leaving the glassy surface of ice on the ground, one can get an impression as if the eternal winter came to stay. At the time of my residing, severe cold was penetrating clothes, it seemed as if it almost does not matter how much clothes one has on, it is still biting cold and for one who does not have to go outside, it is best not to. However, *the inside* at Svalbard is again created into a haven from and a remedy for the arctic winter. There is a dramatic contrast between the indoor and outdoor environments. As the outside is cold, harsh and uninviting, the comfort of the indoors appears amplified. All the indoor lights are warm yellow; the interiors are soothing,

comfortable and more than well-heated, and floors in many of the facilities are made of light wood. To fully enjoy life in the Arctic, one perhaps needs to have counter experiences, between outdoors and one's own home. The fascination with contrasts that Svalbard provides can be one of the reasons to savor this place. Heidi, the local informant recalls her first impressions:

> "I came here in February and it was so dark and it was minus 28. But then the light came back and I understood – this is a place I will stay for a long long time. The place is fantastic. People I work with – perfect people. It is just like Kardemomme by.[23] Everybody looks after each other."

In this hostile and cold environment, people turn to sources of heat in their interiors and in their friends. And after an infinite nightfall, the spring light appears to be even brighter and is welcomed with appreciation - through an annual celebration of the sun's return in March - the Sun fest week.

Many of my interviewees notes that they came to Svalbard for work or partner affiliations, and Statistics Norway[24] survey confirms this (2010 webpage), thus the reasons are similar or no different to usual ones, when moving to any other place. Some additional practical advantages seem of relevance for local people here. Several informants consider Svalbard being the best place in Norway to live for practical reasons, as the low taxes, safety and close proximity between any two locations. Many have mentioned that Longyearbyen has everything that a city would have as the main facilities that constitute city life can be found here, but in walking distance. Similarly

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23 Kardemomme by is an idyllic town from a of Norwegian writer Thorbjørn Egner's children book "Folk og røvere i Kardemomme by"

[24] Statistisk sentralbyrå

to small towns, locals here know each other; while in cities most people are strangers to one another, in Longyearbyen most people are at least acquaintances. In such way, some of the features of a city are contrasted to those of a small community, and softened by small-town relations and more personal every day interactions between the residents.

Much of leisure time in Longyearbyen revolves around outdoor experiences, and this is an exceptional reason for some people to move to Svalbard. People I have talked to here seem to value highly the close proximity to the wilderness and take advantage of it (those few who do not spend a much time outdoors nevertheless acknowledge the privilege). Ana, a local informant told how she and her family go for outdoor tours *"all the time"* especially *"when the lights come back, in March and we can start travelling, that's the best season!"* Having wildlife right outside one's door, and an opportunity to take advantage of it is highly appreciated by many locals, as Heidi puts it here:

> "It's so close, the nature. You just go out the door and you *are* in the nature. It's so special with the blue light and…all year around, it's really special. It makes you want to use it more."

Several informants held a view that people who chose to live in Longyearbyen "*are excited to be here*" and that they believe that nature experience is one of the crucial motives for people to come, or stay in Svalbard. Although the outdoor life is an important Norwegian cultural practice, it seems even more pronounced in Svalbard. It is possible that enjoying the expanse that the outdoor life provides is a counter experience to the tightness of the small town community, since living here where everything is within walking distance may give rise to a feeling of a need for broader space. Furthermore, the choice of activities is reduced in such a

small place, and the outdoor life in the arctic is rather unusual opportunity. Thus for one to choose to come and stay in Svalbard, it sounds as if there has to be something which would be a counterpart to the occasionally claustrophobic small-town atmosphere and a lethargy of a long-winter blues. An opinion poll published by the Statistics Norway states that almost half of the Svalbard residents indeed came here to experience nature, or consider this to be one of the main reasons (2010 webpage).
The Norwegian tradition of outdoor life is being passed on from an early age, and Svalbard is no different from any other place in Norway in this respect, schools in Longyearbyen have outdoor trips year round despite the often severe weather conditions. The local informant Ana explains:

> ”Even kindergarten children learn about their natural environment. They want children to know all about Svalbard, and the environment and animals, everything that’s going on up here. “

Children are taken for hunting and taught about life of animals and the protection of arctic species. The outdoor activities for children are a part of the general attitude here, described by one UNIS researcher as people who are here are the ones who want to experience Svalbard, so *“by default, you have people who are interested in the [natural] environment.*” Interest in the natural environment however can be understood in at least two ways - as interest in spending time in recreational outdoor activities and a concern and support for nature preservation and environmental challenges, and as I will discuss soon, these are not necessarily complementary standpoints. The support for environmental protection is in decline by 6% between 2000 and 2009, when 67% agreed or partly agreed that there is a need for nature

preservation (Statistics Norway, 2010:27). The nature protection efforts and the relation local people have towards these regulations and nature in Svalbard will be addressed in following sections.

The trouble with nature protection

Norwegian environmental ministry is working towards making Svalbard the best managed wilderness in the world (Ministry of Environment webpage[25]), with a goal of basing the decisions regarding nature protection on neutral scientific facts (Syse, 2010:4). The Ministry states that the reasons of protected areas in Svalbard is the fact that "*these areas have their own great value, while being of importance for preservation of the biological diversity*" adding that areas of wilderness together with sites of cultural heritage need to be protected[26] (Ministry of the Environment).

The obvious contradiction to the nature preservation is the presence of the mining industry in Svalbard which stands in a direct conflict with governmental statements, such as for example the one quoted above, on ambition to make Svalbard best managed wilderness in the world.[27] However there is more, perhaps less obvious trouble with nature protection in Svalbard.

The protection of sites of cultural heritage is not controversial in itself, however what cultural heritage is somewhat unclear. The case of a polar

[25] Miljøverndepartmentet

[26] "Slike områder har stor egenverdi, samtidig som de er viktige for bevaring av det biologiske mangfoldet.(...) [V]illmarksområdene på Svalbard (...) skal sammen med kulturminnene sikres mot vesentlige inngrep og påvirkninger."

[27] The coal company Store Norske Spitsbergen is owned in 99.9 % by the Norwegian state, so the nature exploitation through mining enterprise is under the same governing entity as the nature protection law enforcement.

bear is of interest, as it appears to expose the conflicting scientific and governmental efforts, as it blends the scientific and cultural relevance. My local informant Silje for example sees scientists doing "*some good things …like the polar bear there*", referring to the protected status of the polar bear and many other informants saw importance in protecting these animals. This remark would indicate confidence in the credibility of the scientific basis for protection if there was not for two facts. First, polar bears have, according to UNIS biologists miniscule relevance for the ecosystem, and it will go extinct at some point, as large mammals do, thus there is no strictly speaking scientific basis for the protection of polar bears. Secondly, as it will be discussed more later, many other scientific information are distrusted by people, while this information is left unquestioned.

It thus seems that the polar bear is more of cultural heritage in Svalbard than of relevance for the biological diversity, however the relevance is presented to be of scientific nature. Many people have a tendency to feel emotional over such charismatic animals that obtained emblematic status in nature protection, as polar bears, tigers or dolphins. With the belief that science operates on basic truth, these reasons can thus be left unquestioned and undisclosed. As I described in the background chapter, polar bears have something of an iconic status here, and are seen as an emblem of the Arctic wilderness – if Svalbard would lose the bear, it would lose much of its charm and thrill which attracts many to this place. Similar situation is described in the research done by Syse in Scottish area Argyll, where she shows how many protected species have special status due to their cultural and historical significance and even aesthetic properties for people of Scotland, and not for any scientific reasons (2009: 137-171). Needless to say, I am not advocating the neglect of the polar bear nor lifting the protection status, but

merely trying to bring attention to the tendency to apply different set of values to different entities in nature, where some species and areas appear to be more relevant than others for reasons other than scientific ones.

While some protected species are used as indicators[28], the focus on individual species can easily turn into picking and choosing which species or areas will and will not be protected, based on some arbitrary judgments guided by values, but presented as science. In fact ecosystem stability is dependent on its integrity, that is on relations and interactions of individuals of every species, as well as on the stability of other ecosystems[29], especially in the Arctic which is as elaborated earlier, a simpler ecosystem than many others and thus prone to damage and slower to recover. This approach can also lead to some currently non endangered species being neglected, and turn endangered or extinct while most efforts are directed towards a protection of species less relevant for the ecosystem. As Richard Lewontin notes, organisms do not only *live* in their environment, they *create* their environment (1991: 12). Absence of any species (even the polar bear) changes the way environment is recreated further, affecting all the other species.

Furthermore, the protection of regional flora and fauna as entities isolated from other regions, in reality makes no difference when it comes to environmental problems or other ecosystems - individuals of species which

[28] Indicator species are those whose presence, absence or abundance demonstrate quality of ecosystem quality and functionality

[29] The life of a lake depends not only on what happens in its waters, but also what happens in surrounding areas, as the life in water and on the ground are connected. For example, asphalting surrounding areas changes the hydrology in the surrounding, affecting the amount and quality of water that lake receives, in addition to changing the quality of life surrounding the lake. Moreover, living organisms in the water are a part of the same food web as those in the surrounding areas.

are preserved in Svalbard do not have a role in collapsing ecosystems where these same species are gone extinct. If on the other hand, these are not entirely isolated and can freely move between areas with and without protected status, then these can certainly be affected by activities in unprotected areas. Finally, due to the what Giddens calls “empty space”, the focus on isolating certain areas and species still does not manage to isolate them from the global pollution of water and air, or the climate change.

This approach to nature preservation, albeit not unique for Svalbard, seems to be affected by factors other than science, such as historical and cultural circumstances. Furthermore, experts of different fields focus on individual entities, and nature is fenced and given a status, leaving pieces of protected area to exist as self-maintaining systems, separated and unaffected by surrounding regions containing usual human activities. It also appears that the conservation of some areas is based on at times arbitrary decisions.

It is relevant here to discuss these two aspects: first is the fact that certain interests can be met by using science as an explanation, as in a case of protecting species which have no significance for ecosystems in scientific sense. In a case of the bear there are cultural and symbolic reasons for protection, however it seems that many believe polar bears are protected for scientific reasons. In such way it appears clear that values such as cultural significance and economic as well (bears are major tourist attraction here) may be presented and taken as science. The second aspect is the connection between earlier discussed fragmented studies and portrayal of the natural environment with the approaches to environmental challenges. The ideas of nature management are more often than not a mere reflection of such an approach to nature. When there are scientific reasons for nature protection, highly specialized science and expert scientists which

have extensive knowledge on a narrow area and in addition hold different values seems to be producing policies which are selective in their approach, assigning different values to different species and areas.

Welcome to Svalbard?

Tourism is one of the few enterprises that can thrive in Svalbard and the interest in this region is only growing. Being a resident in Svalbard, it is perhaps only natural that, as my informant Silje said "*local people feel this is home*", so calling the sublime nature home constitutes a feeling a unique experience and perhaps a sense of entitlement. This privilege is however contested by visitors. Emma, one of the locals tells me that *"tourists like to come here because they heard this is the last wilderness in Europe"*. Unlike the mining industry, which none of the informants mentioned as concerning, the presence of the tourists is causing ambivalent feelings from the residents.

Before the air traffic was established, Svalbard was one of the destinations on cruise ships polar route. Tourism is today one of most substantial enterprises in the island, generating significant revenue for the community here. Longyearbyen is entirely adjusted to attract and accommodate tourists - there are many souvenir shops, tourist agencies brochures can be picked up everywhere and restaurants have 'local' foods like seal and whale meat on their menu, although as my informants tell me, food is not local in the sense that it is part of the local diet, but an attraction directed towards the tourists. The tourism is most intensive in the summer, but takes place almost all year around.

People in Longyearbyen dislike the tourist, and like cruise ship tourism the least of all. Ship tourists come in large groups at once, and for Anders "*it is fun to see them walk around, they don't walk like individuals, it's like a big*

swarm" while, as he adds, making noise in the night and leaving garbage. Ana describes what it is like when a tourist ship anchors:

> "The cruise passengers…that's the worst. Because they are here only for hours and they don't care much what happens… they don't know even where they are. A lot of people come and ask – is this Iceland, is this Greenland, are we on the main land? Because they have been to so many different ports, that they don't know where they are. And so they don't care if they leave a can of Pepsi on the ground."

Despite ridiculing the tourists, many locals still recognize that Svalbard is limited in its offerings, and that the community is highly dependent on few types of business ventures that the island can sustain. However, the locals I spoke to feel that rules have to be stricter, and the visitors need to be more respectful to places they visit, as Ana expresses here: "*Of course we need them, but we need them to be a bit better prepared for what they are seeing, and they have to be careful."*

Most local informants show a similar posture; many voiced the attitude that that the tourism is acceptable but, as Ana put it *"in a controlled way*". Residents see more fairness in differently set regulations, as several of my informants are of opinion, expressed by Ana: "*Most people living in Svalbard would like these restrictions to be on tourists, not on us locals*". Being a local to any place implies some sense of rights and ownership, and my informants believe that living here, in comparison to just visiting, is a ground for difference in status. The locals appear to perceive the tourists as having lack of courtesy, since they arrive unprepared and not knowing where they are and perhaps give impression they do not care where they are either. They hop in and out of planes and ships, see this sensational place but do not have

to think about tomorrow, nor the consequences of their act, while local people feel protective of their home and do not appreciate this nonchalant attitude.

Also, it is of significance to note that this can be understood as an attempt to achieve a compromise via different status – as nature protection seems to be an imperative for the government, the damage can be reduced by restricting tourist access. All in all, the locals might be suggesting they feel that the tourists are allowed too much, while the locals are not allowed enough. The position that the local people feel they are in I explore more in the next section.

What is the Svalbard wilderness for?

The aspiration to protect nature cannot be overseen in Svalbard. However, efforts and credibility of science behind the nature protection program is, as discussed, contested both by other activities in the island, and by the very approach to protection and management. As nature can be observed from different angles and thus can be a source of dissimilar meanings, there has been a long battle over nature and its resources in trying to establish whose interests, oftentimes conflicting and exclusive, these should fulfill. For example, in the US, the falls of the Niagara river have been debated over since the middle 19th century, in attempt to determine the 'purpose' of the Falls, which act as a source of spiritual pleasure, tourist attraction, a revenue generator and a source of electricity (Spirn 1996: 95-99). Nature in Svalbard found itself in a midst of a similar debate, which is searching for the balance between science, power and local people, its role as a source of knowledge and income, tourist attractions, a haven for personal realization and an epitome of Norwegian nature management.

While the areas in the world considered wilderness are shrinking, Anders notes that in Svalbard, it is "*the area **not** protected [which] is shrinking*". The Governor of Svalbard[30], in cooperation with Norwegian Polar Institute and central government in Oslo is increasing the surface of area restricted for visitors and, according to the Norwegian Polar Institute, as 65% of the surface is under some form of protection by now (Norwegian Polar Institute webpage). According to my local informant Ana, people are notified about the changes, this is information easy to find and usually announced long ahead so that "*you have a lot of time to adjust*". Nevertheless, the expansion of regions off-limits is causing a variety of emotions and reactions among local people on the island, from high discontent, in particular on the part of those engaged in hunting and fishing, to more moderate sentiment of resignation to, in some cases, understanding and support. Ana sounds content with the governmental efforts, although she sees how this can advance conflict:

> "They [the local government] inform very good because there has to be some discussion between the local government, Polar Institute and government in the main land. It's a long process; it's not something happening over night. We get all the information, in the newspaper[31], or you also can get a copy from the Sysselmannen and also [it is] on their web site. It's very good information. I don't have any problems with it. There are many people who have a problem; they get angry that they cannot drive snowmobiles there. For doing it with skis and sleds takes many days, and that's the problem."

[30] Sysselmannen

[31] Svalbardposten

Comfort is an essential part of enduring the life in Svalbard as weather conditions dictate the lifestyle to an extent – most people will chose to drive over a walk in a temperature of minus 30. Ana, having lived here for years, knows the advantages of it, and understands how comfort and efficiency and thus the pleasure of outdoor tours are reduced if one is not allowed to drive. Many others also express their awareness of the importance of protecting nature, but show more discontent if that collides with other needs that they would like to fulfill. Some areas are entirely closed, so not even visits on skis are allowed. A more opposing attitude regarding these kinds of regulations is expressed by another local informant, Silje:

> "We don't always agree. Ok, with some of the areas it doesn't affect all of us, but some people would like to go there and we don't talk about more than 20 a year and I don't see what harm they would do."

This attitude might be in part influenced by the characteristic understanding of nature here, which Torgersen describes in her master's thesis, as robust environment that can tolerate small impact made by people here and there (2010:90). It can appear, at first sight, that the nature under such climatic conditions would be hardened and durable. Silje sees these regulations as an exaggeration, since there are, as she notes only few locals that would want to visit protected areas they would not cause any damage, since the nature must be rather resilient here. Furthermore, as Silje noted, these "*decisions are made without people being listened to*" and with areas being entirely closed to visits and people are deprived of the experience the feel they are entitled to, the locals feel they are put into a position of being unable to influence decisions and an impression that their opinion is irrelevant. So what would people propose regarding changes in these regulations?

> "I don't think people would have anything to say, because they [the local government] already decided what to do and a lot of people think that. If they want to hear your opinion it's just because it looks good. I don't think anything that I have to say really matters. But it would be nice to believe that what I think matters."

Silje is of opinion that the way decisions are made in Svalbard makes it clear that no one here cares how people feel and think. She believes that people feel resigned and any ideas and suggestions they might have they would not provide as the decisions are already made, so giving one's opinion would be only for the purposes of the government's reputation and not, as she may prefer, because public opinion is taken into consideration.

Although Arnstein points out the relevance of real power to influence is described, in contrast to hollow ritual of participation (1969:216), it seems that at times people do not fight for real power, but ask for start for some space to express their opinion. Silje is not necessarily advocating for the power to influence every decision at all times, she is highlighting the absence of the visible interest in the opinions of residents. "*It would be nice to believe that what I think matters*" voices a need for being heard and recognized as relevant and respected member of the society. Silje believes that this can be achieved by hearing the opinions of the locals and putting them, even only occasionally, in practice:

> "Maybe once they could ask us what we want, what we thought […] and they actually did it…that would be nice. I don't think they have done it, ever."

This situation, certainly not limited to Svalbard, is partly created by the combination of earlier discussed processes of time-space separation and disembedding. Through the process of "emptying space", a place is no longer a local entity, but becomes a part of 'a global space' and as decisions are often made by remote and faceless governing systems, then applied to a specific local setting, they often exclude any meaningful form of local participation and generally are not adjusted to the local circumstances. As Longyearbyen is a blend of a modernity and tradition, it moves back and forth between these two distinct groups of features. As noted earlier, the reciprocity between the population and the government in a small and compact community is less of a challenge, than in a community of a greater size, comprising of millions of people and endless environments and interests. Thus, in Longyearbyen, it is not surprising to expect to be included in decisions, as citizens perceive it as a small community where every decision concerns everyone, as Ana points out:

> "I think it is a big difference, because this actually concerns us. Because If I have been living at the mainland and there was a decision [making] there, I wouldn't be concerned very much, if it's not right around my door. But up here we feel it really concerns us."

As many areas are entirely closed, the area of protected sites expanded to the point where, as Anders puts it, "*almost everything is protected now*". How the locals view the actual importance of nature protection then? It is after all, as they see it, the intact natural environment which gives Svalbard its special status of Europe's last wilderness and what so many seem proud of. Ana said that they are indeed "*very proud [of our status], but we would also*

want to go to these special places" and Silje elaborated the balance between the importance of protection versus having the experience in the nature of Svalbard:

> "You have to have restrictions on some areas, you do, but I think it's wrong to close it down because then you can't see it. I thought it was a fantastic experience to go there [areas that are now closed]. That's a shame, because it is a lot of history that people can't see, they just have to read about it in a book. And I don't think that's right, because I think you should be allowed to see what it is like. But not in big groups, I went there with tourist ships, I know what that can be like, but in small groups would be ok."

Silje might perhaps prefer some sort of limited visitations, over closing an area entirely as 'seeing what is like' and experiencing Arctic wilderness is the allure of the local life, for many it is the way to enjoy life here. They know that experiencing the wild nature here is thus not reading about it in a book or seeing it on television, as one of UNIS researchers also noted when speaking of media portrayal of nature – own experience of being somewhere is quite different than anyone else's description or reproduction of it. Silje, as she told me, had an opportunity to see many areas that are now closed for visitors, and is trying to convey a sentiment that it is unfair to deprive others of having the same encounters with this nature. It cannot be described in a book or recorded, it has to be seen in person, smelled, inhaled and touched - felt with all of senses. Limited visitations would thus be carried out in permissions for people who live here (but not necessarily those who visit), to have these extraordinary experiences.

Here I also believe my informant was touching upon a crucial question, which can be posed in any case of wilderness protection – *who* and *what* is the wilderness protected *for*? In her eyes, if no one can see, experience and marvel the wilderness, what is the purpose of this protected wilderness then – a mere existence of it? Locals recognize importance of nature preservation, but they also insist on being allowed to experience life in the way they find meaningful. The attitude held by local people, that seem to be omnipresent in Svalbard, is thus epitomized in words of local informant Gro: "*Of course we should protect nature…but not too much*".

In some cases these decisions are seen to be flexible for some groups in the community, for example researchers. Scientists are seen as having an easy way around the regulations. Being a scientist, in the eyes of my local informants provides a special status, as one Frøydis explains:

> "It's so easy for scientists to just come up here and say – I want to do research. Because you are a scientist, you get the permission and you can go [into restricted areas]. They always take the easiest way and they always get the money they need all the time."

There are areas which are of scientific relevance and open only for purposes of research, while others, still highly relevant for research are inaccessible due to protection status. On the other hand, scientists are perceived not only as having an easier way around, there are many who view science workers as creating the nature protection regulations. The next section is going to discuss people's relation to experts and expert knowledge and the dynamics between, which takes place in Svalbard.

"When science speaks, let no dog bark" [32]

As noted earlier, science is perceived by non scientists as a source of absolute knowledge. In his critique of science "The doctrine of DNA: Biology as ideology", Richard Lewontin states that science understood as truth producing leads to scientific truths to be taken as a fact of life which cannot be contested (1991:8). Here, I will discuss how this way of understanding seems to be materializing itself in Svalbard, providing grounds for conflict and resistance to expert knowledge on the part of lay people.

It is not only the government who is seen to be restricting access to nature, it is also the scientific community - scientists are seen by some people as a part of controversial decision-making mechanism. Due to the fact that much of scientific information is not provided or not provided in a comprehensible manner, there is an unequal distribution of knowledge which appears to be one of the factors that determine the division between science and society. This is perhaps in some cases less due to its effect of depriving a nonscientist of an actual knowledge he or she might have interest in, and more due to the exclusion, inequality and disempowering effect on the individual by the use of scientific claims as undisputable facts and thus, as I will show, conditioning and controlling one's behavior.

As discussed earlier, Giddens defines the relation between lay people and the expert system as being based on trust, and in the fundament of all trust relations lies ignorance, which in return serves as a ground for "*skepticism, or at least caution*" (Giddens, 1990:89). What gives rise to the skepticism is

[32] Lewontin, R. "The doctrine of DNA: Biology as ideology". The original phrase is spoken by Gratiano, in The Merchant of Venice: "And when I ope my lips, let no dog bark!" (Act I, Scene I)

likely a feeling of being vulnerable without having knowledge in terms of never knowing which purpose this knowledge will serve.

The quality of trust relations is determined at what Giddens calls the access points, i.e. *loci* in time and space where lay people and representatives of abstract systems meet. The experience that the lay people have at these encounters is critical for the attitudes people adopt towards these systems (ibid: 84, 90-91).

Locals in Svalbard sound as if they do not have an overwhelmingly positive experience at these access points with expert systems. They also do not always see the relevance of scientific work in Svalbard, as some of my informants understand it, science here is just "*something popular to do*". In asking the locals for example *why* the restrictions are posed on some areas, and what these are protecting nature from, I frequently came across a lack of familiarity with the grounds the regulations are based on. The ideas on why restrictions exist seem to be elusive and associated with one particular example that everyone here knows – a danger of leaving a footprint or a tire track print out into tundra, because as locals explain it, "*it can stay there forty, fifty years, so we have to be very careful.*" While walking or driving on the ground, even covered with snow can be damaging to the soil and its life, it might be not be easy to see how this activity "*by not more than 20 locals a year*" would destroy the area, and despite of being stated as a fact by the locals, it appears that most are not convinced. With a perception of Arctic nature as robust and resilient, and without comprehensive explanation of actual wider damage (by noise, exhaust, the disturbance of wildlife by variety of activities from snow sports, setting up a fire or a camping site etc.), local people may feel forced to accept the given explanations even if these do not make much sense or are incomplete. Perhaps precisely because

they are not offered a comprehensible explanation for being prevented from fulfilling their interests, people might have impression of being manipulated, and a rule as this one can be viewed as using (undisclosed) knowledge less to prevent damage on nature, and more to exercise power.

Researchers have encountered a resistance to this sort of conduct within different groups in Svalbard. In her research on the conflict over the Arctic char fishing regulations in Svalbard, Syse interviewed fishermen who were discontent over a decision to introduce quotas and catch reporting. As fishermen perceived it, the reasons for the decision were unclear to them, and based on what they saw as flexible and vague scientific knowledge (2010:9). The conflict and the resistance by these men is, as the report shows, not necessarily induced by the very regulations or fishermen's lack of concern for the environment, but more likely by insufficient *explanations* on needs for quotas, as well as how these are established and what they are used for (ibid.). The fishermen could thus perceive this regulation introduction as exercising power and control, not only over char numbers but over people. This is likely a result of "scientists not bothering to explain" science, while scientific arguments have to be taken as facts and as such cannot be argued against, so it becomes easy use it in restraining people's activities, that is – to use knowledge as power.

Adding to the conflict is already mentioned impression that the scientists (and governmental officials) do not have to obey to the regulations - as Silje tells me "*they are allowed to go where ever they want to go, but rest of the people can't"* and that *"they can do whatever they want to do in those areas*", while deciding who else can go where and what is and is not allowed to do in which areas. These conflicts are further intensified and the trust in experts undermined by instances of power abuse becoming public, such as an

infamous case of a Svalbard governmental officer photos, posing with a substantial fish catch, which emerged online (Fiskeguiden.no webpage). Such events indicate that the rules do not apply to everyone, and that experts indeed can do what they want while the public only learns about it on occasions when these instances are, often by mistake disclosed.

I will propose what I see as a bottom line notion regarding reactions and resistance to the nature protection regulation. Many areas that are restricted for visiting are also relatively far from Longyearbyen, some of them within days of travel, one might wonder how this really affects anyone in a significant way when there are other regions, closer and open for visiting. In one of the conversations with a local informant a relevant insight emerged. When asked why people object so much on restriction on sites which are so remote, Gro answered: "*Because they want to be free, I think*."

Many people have a yearning towards a feeling of freedom. The one, who has experienced Svalbard, or scenery of a similar magnificence, knows that extraordinary landscapes may, just like Cronon describes, inspire one to ponder and experience awe and give a sense that human beings can be free, from insipid routines, everyday worries, from work and conventions, social obligations and reminders of power, control and social order. An inherent human desire for space and freedom can, for some, be realized in wild nature. The restrictions, exclusivity of knowledge and thus maintenance of power order all diminish a feeling of being free. If one's own position and the value in society are reduced, by controlling a part of the population and activities meaningful for them, while allowing the same activities to others, this can be seen as essentially denying a right to freedom to some. As Syse writes, having power means being able and having a possibility to realize own interests (2009:198). In the end, people might not be fighting only for

nature experience or a right to catch as many fish as they like, or for more knowledge on nature management, they might also be fighting for right to feel fulfilled, realize their interests and against what they see as oppression, in an a slightly Orwellian atmosphere, where they perceive the situation as - he who controls knowledge, controls people. Due to the specific circumstances in Svalbard, lack of power and freedom are manifested in limited access and controlled activities in nature.

Zen or the art of technology maintenance

I want to close this chapter with a section that consolidated itself during the process of analyzing and writing about other aspects of my topic. Nonetheless there were some data that were emerging every now and then, not fitting into the rest of the analysis. This was indicating a need to pay attention to the fact that the topic on relation between science and society is also pointing towards the relation that humans have towards nature. The final section of this chapter will discuss the role of technology, as a scientific application, in the natural environment of Svalbard.

The uses of scientific knowledge in a form of technology are implicit in every social domain today, so its ubiquitous presence is often overseen; the Science and Society Third Report states that people take technology and science for granted in everyday life (Ch.1, §1.1.). This is perhaps why we do not question the fact that in the midst of the last wilderness in Europe, a mining industry is in full operational speed and that, when we search for wilderness, one of the most common tools we use is precisely the antipode to the wild. Erich Fromm illustrates the dangerous side of technology, in terms of for example warfare destruction turning into technical production, is that a worker and an engineer are both entirely alienated from the

product of their work – they perform technical tasks, but often do not even see the final product of their work, and are not suppose to ask themselves whether the product is useful or profitable – that is decided by the management (1973: 346). When talking about alienation via technology, Fromm is also calling attention to the fact that the site where the consequences of our actions take place is oftentimes remote and is thus outside of our immediate experience. [33] In such way, it does not seem surprising that a great deal of our decisions and actions can contribute to the environmental degradation – if we use (efficient but harmful) chemicals to clean the bathroom or drive a car to work, we almost never see direct chain of events, i.e. how something I do leads to the pollution I see, and we are not witnessing how these two simple activities are having devastating effects on nature – at sites far away from our daily experiences.

Technological inventions enable modern life, but also limit some forms of human experience - Rothenberg says that being opposite to personal level of knowing, technology is showing us that "*our dreams are constrained by what we are able to do*" and wonders if we can perceive anything more than technology allows us (1993: 1-2, 25). Relying on technology we might be able reach only as far as technology reaches. In terms of our relation to natural environment, besides being seen as our main accomplice in the destruction of nature, technology can also be understood as alienating

[33] Without a possibility to investigate the phenomenon in depth here, I want to mention the approach Fromm takes when it comes to alienation via technology. Speaking of the connection of technology and destruction, Fromm notes that for example, in the World War II, military pilots that dropped bombs which were killing thousands within minutes were largely unaware of the devastating effect their actions have – their job was limited to operating the plane and its complex machinery. While knowing cerebrally that they are destroying humans, they did not comprehend it affectively, and unlike ground soldiers who are much closer to the results of their acts, the technology enabled the airplane crews not to witness the suffering their work results in (1973:346).

humans from wilderness and disabling the nature experience in its integrity, due to its own limits.

Longyearbyen community being a highly modernized society bordering wilderness creates another seeming contradiction –people appear to be searching for the pristine, yet venture into it only fully equipped with the inventions of modern science. In Longyearbyen, for example, while having a possibly profound spiritual experience, standing at a cliff on the edge of the town admiring the sublime landscape, one may oversee paradoxes – for example, a convoy of snowmobiles and cars in the mountain, rushing back into the town in the late afternoon. Upon returning, one can find oneself in a daunting, strange mist and an even more unusual smell which is dominating the Longyearbyen valley. The blue-gray haze hanging over the town and the smell from the exhaust is dominating the inhabited area.

To digress slightly - Rothenberg sees technology as changing the purpose of humanity through changing our essence (1993:24). While this statement may pose a question about the purpose of humanity and is there any such thing, his perception of effects that technology has on us, applied on the ways we relate to nature is still relevant, because the technology might be changing the essence and the quality of experiences. Rothenberg believes that the way we see the world depends on the way we use it (ibid: xii), and in such a way, if we do not discuss whether technology changes our purpose, it might still be argued that advances in technology and thus change in the way we use the world alters our perception of it as well. In addition, I would note here that that the way we see the world also *determines* the way we use it, so our altered view perpetuates the change of the modes of use. And as we view the natural world through the spectacles of technology, "*modifying it into something that can be used and manipulated to submit to our needs and*

desires" (ibid.), our notion and the experience of the natural world might be dramatically different from the actual physical world of nature.

The environment around Longyearbyen is modified to meet our modern needs - the haze over the town is in fact the air pollution originating from fossil fuel combustion. As Torgersen's research shows, driving snowmobiles is the one of the main passions here, especially among young men, who use a phrase "my snowmobile and I". For young people here, driving a snowmobile is a form of having fun in a place that offers limited pastime activities (2010:42). There are more snowmobiles than people in Longyearbyen, locals tell me, as these are the main transportation means both inside the town and out, and they are also available for tourists during the snow season. Together with cars this generates very frequent traffic, however some locals tell me driving has no significant impact on the environment here. Since Longyearbyen lies in the valley, the pollution and the smell remain long at the bottom, kept and compressed in the low layers of atmosphere. The fossil fuel pollution is highest during the spring (April-May) and it is on account of technology that the place perceived as pure and pristine, has at high season, according to Reimann et al. the levels of pollution of those in Zurich (2009:4791). Some of my informants believe that snowmobiles have no impact on the environment, others see that this might be an issue; Torgersen notes that the use of cars and snowmobiles was criticized by some residents, as well as in the local newspaper (2010: 40). So why does no one seem willing to give up practices which are damaging to nature?

When venturing outside of the town, having a possibility to drive long distances, and bring a rifle and navigation gear such as GPS receiver or avalanche beacons might also maintain a feeling of safety and comfort in the

wilderness. One is aware that having such equipment makes their position known and monitored via satellites by the receiving centers[34] so in a case of accidents, one will be heard in a call for help. In such a situation, one might not perceive one's own vulnerable position in wilderness as such. The technology might be changing our perception and experience of nature through altering the feeling one has in the wild – not only easily reached and already seen on postcards and screensavers, but due to possibility to be safe in the unsafe environment, one may no longer see wilderness as terror-inspiring, or feel timid and left at the mercy of the Arctic environment.

As I noted earlier, the case of the presence of natural resource exploitation industry none of the informants mentioned as problematic. This may indicate that the industry is seen as vital element of life here, and is thus in some way a part of the environment. Together with the effect on the natural environment that excessive traffic and pollution have, and technological gear used in wilderness adventures, in a place perceived as intact wilderness, the technology use perhaps exposes our contemporary idea on what wilderness is - not only a human intervention but a human invention. The notion of wild nature is being modified via available technology, which can be viewed as another demeanor of a modern, global society, which both delineates and obliterates the divergence between the natural and the cultural.

Nonetheless, while technology can be understood as much as the advancement of scientific knowledge and a demonstration of human folly, it is also a facilitator of an unparalleled detailed knowledge on nature as well

[34] The monitoring center for Svalbard is in Tromsø, Norway

as unique nature experience. The snowmobiles that seem to be appreciated by the locals and the tourists almost as much as nature itself take people into adventures outside the town, in a relatively comfortable and efficient way. Walking does not get one very far, since when one walks, say Ana "*everywhere you go you can still see home*". One of the Torgersen's informants told how she enjoys driving her car outside of town - it provides time to be alone and to think (2010:41). Long driving may have a meditative effect, and as the urban life with all its advantages can fail to provide a space for a retreat, a getaway is what gives an opportunity for solitude. Finding oneself far away from everyday life, and before a sublime landscape, one might catch a glimpse of God, ponder life or simply enjoy the silence - it is the modern society we at times try to escape that gave us means to escape, and technology can thus be understood as an imperative in spiritual and nature experience.

Thus, the use of technology has the other side – it is what makes both knowledge and experiences possible - the safest and quickest way to come here is by plain and the way to enjoy one's stay here is to make interiors warm, and nature close, hence the mining industry and the frequent traffic. As much as it can be argued that technology makes nature in its integrity inaccessible, in Svalbard it is often the only way to reach both nature and a sanctuary, even if the ultimate experience is altered and some damage made on the way.

If one may feel compelled to admire nature's might, appreciate an opportunity to marvel, galvanized by the stunning landscape of this remote place, the use of technology seems indispensible to obtain this experience in a relatively safe and comfortable way. Getting to nature is aided by technology, in case of Svalbard, due to climatic conditions, fauna and

landscape, the alternative could be not having this experience at all. A seeming paradox of technology in wilderness may suddenly turn sensible, as we shape our practices to meet our needs. When one uses a plane, a car or a snowmobile as means of achieving a sense of freedom, a moment of solitude or simply wanting to contemplate landscapes there is no contradiction in using technology to experience nature. For most people, technology is an integral and indispensible part of a contemporary nature experience.

6.3 Final comments

In this chapter, I have presented features of life and social relations, as well as relations to nature in Svalbard, which are relevant for understanding the attitudes lay people have regarding science, technology and nature.

From a relatively uninteresting and hardly accessible area, the Arctic turned into an *it* destination, owing to its exotic features, which provide different kinds of fulfillment and experience as an alternative to perhaps more conventional destinations and resorts. This is resulting in a rapidly shifting situation for the Arctic, which while retaining a portrait of a place of serenity and intact environment, is becoming a battleground for different interest.

The notion of wilderness itself has gone through a transformation over time, and while continuing to be somewhat elusive, the extent to which it is delineated includes human interference as a defining part of it. A seeming paradox, in an era of modernity there seems to be nothing which is not affected by human presence – wilderness might not longer mean nature unaffected by humans, but actively protected by humans.

The presence of tourism is provoking ambivalent attitudes, and people while recognizing the relevance of this venue, feel protective over what they see as

their home and believe that, as a local, one is entitled to a status that visitors would not have.

Wilderness in Svalbard, a place of inspiring beauty, is also a contesting terrain where science, governance and lay people meet. The conflict over rights to nature here, and the ways that the science behind nature protection is presented and implemented, while restraining people's activities, seems to be feeding the resentful attitudes that people hold towards science and scientists. The area restricted for people is expanding. Locals are of impression that this is done for reasons undisclosed to them, and that is more often than not an exercise of power rather than necessity. Many people I encountered acknowledge the importance of protecting nature, however this often stands in contrast with some of their other needs, especially as the fulfillment of these interests is one of the main appeals of the life here. Decisions made without listening to people propel a conflict, which is accommodating a much wider area that actual *nature*, and includes one's position in society in terms of social value, lack of power and rights to a pursuit of personal fulfillment.

The use of technology is prominent here and it appears to be contradicting the sought experience of 'wild nature'. In its assistance, technology is making us bold to keep trying to put nature under human command, in order to tame it, escape from its wrath and fury and essentially to profit materially from it. However, the other side of the technology in nature is that it what enables the nature experience in a modern society, and is thus indispensible.

7. Towards a conclusion

"A popular scientific lecture - that is a lecture intended to make you believe that you understand a thing which actually you don't understand." (Wittgenstein, 1965:4).

In his only popular lecture which he delivered at Cambridge in 1929, Ludwig Wittgenstein called "*a superficial curiosity about latest scientific discoveries*" one of the lowest human desires (1965:4). If this quote illustrates the approach to popularizing science, then this approach to science mediation would need to change in order to alter the relation between science and society. The existence of a genuine desire among lay people to know more about science is reasonable, justified and desirable in today's world. Rather than making people *believe* they understand science, the skillful articulation of science may get people to *actually* understand more of science. Taking in consideration the obstacles presented in this chapter, any effort on the part of academia to communicate their work and on the part of the audience to grasp it, is more than welcomed. I will now discuss the domain of science articulation when it comes to improving a relationship between the science and society.

The modes of today's science articulation pose a great challenge both for those who are scientists and those who are not. Some of the burden is brought on us by conditions of life today, as modernity created highly interdependent world. One of the greatest challenges, I believe, is to synchronize the social systems that shape our understanding of the word with the features of the world today. When we speak of education, which appears to be a fundament of the comprehensive science articulation and understanding, I believe it is highly relevant to notice

that the style of educating is somewhat bygone, that seems to be lagging behind the rapid changes of the world. This style might have been appropriate in pre-modern times, but is creating a disadvantage for many people today, whose navigation through society and life often times requires more knowledge and understanding of science and an ability to think critically about the world. *"As the practice of today rests on science of yesterday, so is the research of today practice of tomorrow."* (Merton, 1938: 325). Similarly, the education would need to look forward, because in the future is where we use it. For now, our educational systems seem not only unequipped for the present, but as if they still dwell in the past.

With education adapted to the pace and scope of the modern cultural changes, I believe the other obstacles presented here would also be diminished in their effect – although it would be impossible to succeed in totality, education can provide better equipment for understanding scientific language and to become more familiar with the nature of scientific investigation. In addition, the education rests upon obtaining and collecting information and facts, i.e. students are being passive receptacles, rather than stimulating thinking process which would lead to new ideas.

There are other components of this problematic, beside education although it appears as if it is the changes within the education which can have a ripple effect, affecting many of the other elements discussed here such as familiarity with the scientific language or the awareness of the unrealistic portrayals of nature by the media. Moreover, becoming more aware on the part of scientists, that the way nature is studies and portrayed provides pieces of nature which most people, including the

policy makers cannot put together in a comprehensive way – might commence a search for a change within the modes the nature is examined and presented.

Finally, if articulation of science is low on the priority scale, as one UNIS informant noted, due to other obligations, many science workers would decide to chose fulfilling these other tasks before the public outreach, or even feel that they are not offered a choice at all. Evidently, there is a need for a systemic modification within the academia and a change of priorities, if we are to increase understanding of science, and when it comes to environmental science – if we are to achieve a motivation for a change of our routines in a direction of more responsible living.

The matter of public understanding of science is not only a matter of making information available or channeling them articulately or cohesively; it is also a matter of trust and confidence in the scientific community, and this trust, beside being as Giddens sees is inherently ambivalent, is further undermined by perceived uses of science for purposes other than scientific, such as to maintain power, social inequality or control. Nature is a subject to different values and our use of it depends on our perception and evaluation. For example, areas where the mining industry is located seem to be irrelevant in terms of nature protection while certain species are under protected status in spite of little relevance they in fact may have for the ecosystem stability. This fragmented and value-laden approach to nature is inevitably ending up in nature protection policies as well as bringing the credibility of scientific knowledge in question.

The technological uses and applications seems to be changing the way we perceive and experience nature, both in terms of implying the presence of

technology in nature, inability to see the wholeness of the natural world and thus oftentimes overseeing the damage that is brought on nature as well as in terms of technology enabling precision and detailed knowledge and experiences that provide recreation, spiritual fulfillment and a sense of freedom.

The nature in Svalbard is the battleground where science and the rest of the local society collide. Residents of Svalbard seem to see the importance of preserving nature in its primordial state; it is the perceived pristine natural world that is a major reason for their stay. It appears that the access to meaningful and fulfilling personal experience, one of the few people can engage in here and certainly one of the most awe-inspiring that one can have, is what the locals do not want to be taken away.

But there is more to the metaphysical element of nature experience in Svalbard. If the people distrust the information they receive and if they are of impression that they are excommunicated from knowledge and decisions so that the information can be misused when needed, then efforts aimed at the credibility of not only scientific information but the use of these information appear just as essential as articulation of science. For people who live here, the resistance towards extensive nature protection is oftentimes a resistance towards perceived oppression, disempowerment and injustice, and science is seen to be an accomplice and thus the opponent. Today's scientists are, unlike in the British Empire, part of the powerful social groups, i.e. an integral part of abstract systems, which corresponds with the situation in Svalbard. Here, people do not make a significant distinction between the government and scientific community – they are all one system which has exclusive rights to the knowledge, means of controls and a privilege to not obey own regulations. In other words, the locals could

perceive situation in following terms: those who posses knowledge have power, the fewer people share this knowledge the fewer people have the power. Thus, knowledge does not have only intellectual or educational purposes which in itself can work as means of liberation and empowerment. But sharing knowledge enables inclusion and provides a sense of respect and freedom to pursue own sense of being fulfilled might thus seem less compromised. I believe that more even distribution of knowledge would improve the situation significantly, in particular when it comes to participation in making decisions which might also have an effect on the practices which reflect on the environment.

The level of non-participation in decision making (but also knowledge sharing) may be directly proportional to a level of resistance. There seems to be a direct link between the level of participation and the obedience to decisions - the more the individuals are involved in making decisions, the more likely it is that they themselves will respect the boundaries imposed by decisions (Ockwell et al: 315).

The involvement provides an opportunity for being better informed and thus understand the issue more in depth. This is furthermore likely to result in more positive attitudes towards the decisions one sees as, in the light of expanded personal knowledge, more reasonable and justifiable. But this is less a conflict over knowledge, in fact increasing knowledge might not be change the situation alone. Elaborate and inclusive decision-making provide an impression of being valued as a respected member of society, and can result in reduced skepticism and resistance. Also, if the decision making has in fact had included some of the matters the public is concerned with, the outcome might be much more in compliance with the interest of the public and thus more acceptable to it as well. Finally, being included into the circle

of knowledge holders facilitates not only a feeling of being more knowledgeable, but also that of being empowered.

In terms of environmental science, and nature protection as a part of it, I believe that any solution would need to take into account specific needs of a community and local circumstances, and the ways our need for freedom and happiness materialize themselves cannot be neglected.

In the end, I believe that the challenges of Svalbard might translate to other communities, and perhaps to a larger society. A more inclusive approach, that would entail working on improving articulation of science on all levels and recognizing citizens as valuable members of society would, I believe, largely improve the relation between the scientific community and the rest of society. I am indeed aware that the changes I suggest would have enveloping socio-political ramifications, in particular when it comes to power relations and protection of interests of certain groups which is indeed a topic too complex to be investigated here. I am also aware that suggested improvements may sound naïve, even utopian. Nonetheless, in a spirit of Francis Bacon and his vision of science working for a better world, I believe it is essential to keep pushing the frontier having a vision, not in order to arrive at it but in order to continually strive for it.

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