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"Bring the Vast Unthinkable Down to Earth"

Popularization and Usability in *A Short History of Nearly Everything* by Bill Bryson and its Finnish translation

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TABLE OF CONTENTS

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Discipline: English Studies
Author: Emmi Hautala
Master's Thesis: "Bring the Vast Unthinkable Down to Earth" Popularization and Usability in *A Short History of Nearly Everything* by Bill Bryson and Its Finnish Translation
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ABSTRACT

Tässä pro gradu -tutkielmassa tarkastelen miten popularisointi ja käytettävyys näkyvät Bill Brysonin kirjassa *A Short History of Nearly Everything* ja sen suomennoksessa *Lyhyt historia lähes kaikesta* (suom. Markku Päkkilä). Käytettävyydessä keskityin yhteen sen alalajiin, audience designiin. Vaikka popularisointia ja käytettävyyttä on tutkittu paljon, en löytänyt yhtäkään tutkimusta, jossa niitä tarkasteltaisiin yhdessä. Tutkimuksessa näyttäisi olevan aukko, mistä syystä näitä kahta näkökulmaa, käytettävyyttä ja popularisointia, on syytä yhdistää käännöstutkimuksen teossa. Tässä tutkielmassa minua kiinnostivat kaksi kysymystä: onko lähdetekstissä ja käännöksessä eritasoista popularisointia ja miten lähtöteksti ja käännös ottavat käyttäjän huomioon. Ennakko-oletukseni oli, että lähdetekstin ja suomennoksen popularisointi oli samalla tasolla. Koska analysoin materiaalia kahdesta eri näkökulmasta, nojauduin kahteen eri teoriapohjaan. Käytettävyyden teoriapohjana käytin Allan Bellin kehittämää audience designia ja sen luokittelua eritasoisiin vastaanottajiin. Popularisoinnissa puolestaan keskityin huumoriin ja termien lisäämiseen tai poistamiseen, koska ne nousivat materiaalista selkeimmin esiin. Materiaaliksi valikoitui Bill Brysonin kirja *A Short History of Nearly Everything* ja sen suomennos, koska olin lukenut molemmat kirjat aiemmin. Molemmissa kirjoissa on kuusi lukua sekä useita alalukuja. Kirjojen laajuuden takia rajasin materiaalin vain kunkin luvun kahteen ensimmäiseen alalukuun. Analysoinnissa hyödynsin itseäni ja omaa kokemustani popularisoidusta kirjallisuudesta, eli suoritin heuristista arviointia. Lisäksi haastattelin lyhyesti kääntäjä Markku Päkkilää LinkedIn-verkkopalvelussa. Analysoinnin jälkeen ennakko-oletukseni osoittautui oikeaksi; lähdetekstissä ja käännöksessä ei ollut eritasoista popularisointia ja ne olivat molemmat ottaneet käyttäjän huomioon muun muassa selittämällä annettuja termejä ja tarjoamalla hyvin laajan hakusanaluettelon. Tutkimukseni loppupäätelmäksi tulikin se, että tässä kyseisessä materiaalissa käytettävyys ja popularisointi ovat hyvin lähellä toisiaan. Jos muiden tutkijoiden tuloksista käy ilmi, että näin on myös muussa popularisoidussa kirjallisuudessa, tätä tutkimustulosta voidaan hyödyntää parantamalla popularisoidun kirjallisuuden käytettävyyttä. Lisäksi tämä tutkimustulos voi rohkaista lisää tutkijoita popularisoinnin pariin.

KEYWORDS: a short history of nearly everything, audience design, bill bryson, lyhyt historia lähes kaikesta, popularization, usability

"Make me wonder / Make me understand / Spark the light of doubt and a newborn mind / Bring the vast unthinkable down to Earth"

Nightwish: *Sagan* (2015)

1 INTRODUCTION

In this Master's thesis I shall examine popularization and usability. The material is collected from a book called *A Short History of Nearly Everything* by Bill Bryson and its Finnish translation *Lyhyt historia lähes kaikesta* (translated by Markku Päkkilä)[1]. *Short History* was first published in 2003 by Doubleday; the version I am using was published in 2004 by Black Swan. The Finnish translation was published in 2005 by WSOY. I have two research questions. The first is "Are there different levels of popularization between the source text and the target text?" while the second is "How do the two texts take the user into account?" In addition, I hypothesize that the source text and the target text are at the same level of popularization, meaning that the books are catered towards a readership with the same level of knowledge.

Popularization is a fascinating subject because the opinions concerning it are so diverse. For instance, Roger M. Downs, Professor of Geography, is of the opinion that popularization cannot be either good or bad, only successful or not successful (Downs 2010: 447); others, like Rae Goodell[2], PhD in communication research, insist that popularization ought to be left to veteran researchers who no longer do research actively (Kiikeri & Ylikoski 2004: 191). Mika Kiikeri and Petri Ylikoski further point out that those researchers not engaged in popularization justify their decision by claiming that popularization could possibly harm their careers and that the time devoted into popularizing their research is away from actually doing research. At the same time, however, these same researchers believe that others use popularization to advance their own careers. (ibid. 190.) Similar results were found in a survey commissioned by the Royal Society; of the scientists and engineers surveyed, 64% said that their research was taking all of their free time, which limited their involvement with popularization,

[1] From here on the books shall be referred to as *Short History* and *Lyhyt historia*, respectively.
[2] Kiikeri and Ylikoski misspelled her name as Rue Goodell

while 29% of those surveyed answered that the time spent in engaging with the general public was taken away from their research (Royal Society 2006).

In stark contrast to the above, popularized science magazines are quite well-liked among consumers. For instance, in 2013 the circulation of the *Discover* magazine was 558,484 sold copies in the United States, while *National Geographic* and *Popular Science* sold 4,029,881 and 1,304,017 copies, respectively (Alliance for Audited Media 2013). In Great Britain, the popular science magazine *BBC Focus* has a circulation of 70,100 (Immediate Media Co. 2014a), while the astronomy magazine *BBC Sky at Night* has a circulation of 24,100 (Immediate Media Co. 2014b). In Finland, the circulation for popular science magazines was 57,566 copies for the *Tiede* magazine and 36,269 copies for the *Tieteen Kuvalehti* in 2013 (Levikintarkastus Oy 2014). Clearly, there is a demand for popularized content.

Despite popularization and usability being popular research topics, they have not yet, to my knowledge, been combined in research. For this reason I have chosen to include both topics in my MA thesis. As can be seen from the above circulation numbers, popular magazines are well-liked by consumers, and therefore I believe it is important to study popularization and usability together. By doing this research, it may be possible for science communication to reach more people that it does now. The public could also be encouraged to become more familiar with the world of science and scientists could find new avenues to communicate their ideas to the public.

This thesis is a case study. In other words, I do not intend to examine larger samples nor the entire field of popularized books or magazines; instead I focus solely on how popularization and usability manifest in *Short History* and *Lyhyt historia*. My aim is not to make claims or predictions about how to improve knowledge on popularization. Nevertheless, I may comment briefly on its current status if it helps to explain something that arises from the material. Because I combine the research of usability and popularization, I also have two theoretical frameworks. For usability, I utilize Alan Bell's audience design, while the theoretical framework for popularization focuses in particular on humor and the addition and omission of terms. These two popularization

strategies were chosen because they emerged strongly from the material. In addition, I briefly interviewed the translator Markku Päkkilä via LinkedIn. Since I was doubling as both a reader and an analyst, I used heuristic evaluation as a method.

Concerning the structure of the thesis, I will discuss the material and the method in sections 1.1 and 1.2, respectively, while section 1.3 discusses the historical reactions to popularization. The theoretical framework of this thesis is divided into two chapters. The first, chapter 2, is dedicated to scientific translation (section 2.1) and usability and audience design (section 2.2). Chapter 3 discusses the second half of the theoretical framework, popularization, and there are two sections. Section 3.1 focuses on the differences between two different views, called dominant view and continuity view. Section 3.2, on the other hand, discusses popularization as a social process. Analysis is found in chapter 4, which is further divided into three sections. Section 4.1 concentrates on how usability occurs in the material, 4.2 focuses on the popularization aspect while the possible similarities between popularization and usability are examined in 4.3. Finally, in chapter 5 I will draw conclusions and discuss the limitations and further research ideas based on this study. The title of this thesis is taken from the song *Sagan* by Nightwish. Since the song is about the astrophysicist and science popularizer Carl Sagan, I felt the lyrics would make an appropriate title for this thesis.

1.1 Material

In this subsection I shall give an overview of the material, namely the *Short History of Nearly Everything* and its Finnish translation *Lyhyt historia lähes kaikesta*. The material also included a brief interview of the translator Markku Päkkilä. It must be noted that I did not use the entire book as my material; instead, I chose to include the first two sections of each of the six chapters. In other words, my material consisted of twelve chapters in total. This way, it was possible to narrow the scope of the thesis and still be able to address every area of the book.

The American-born Bill Bryson's critically acclaimed book *A Short History of Nearly Everything* (first published in 2003) is about the history of science. In the introduction,

Bryson explains that he was motivated to write the book because he realized, while looking out of an airplane window, that he did not know much about the planet he lived on. He was not even certain how people could possibly know how much the Earth weighed, or how the universe came to be. (Bryson 2004: 23.) The textbooks he used in his youth were extremely dull and therefore he decided to write a book to see if it was possible to write about science in an understandable and perhaps even enjoyable way (ibid. 23–24).

Short History is divided into six chapters, and each of them is dedicated to a different field of science. The chapters are seemingly arranged into a rough chronological order: the first chapter recalls the birth of the universe while the last chapter discusses the evolution of human beings. However, there are instances where the one chapter discussed the findings of the 19th century while the next one moves on to the 1920s. Each of the six chapters is further divided into several subchapters, ranging from three to eleven in number, which discuss the overall subject from different perspectives. For the book Bryson interviewed several notable scientists, other experts and science enthusiasts in order to get answers to his "outstandingly dumb questions" as he himself puts it (Bryson 2004: 24).

As was already pointed out, the first chapter of *Short History*, "Lost in the Cosmos", is about the birth of the universe, but it also discusses other astrological matters. In addition to how the universe came to be, this chapter focuses on our solar system and the discovery and status of Pluto[3]. The discovery of the cosmic background radiation by two young researchers who were, in fact, looking for something else entirely is also one of the topics of this particular chapter. Introduced in this chapter is also the Revered Robert Evans from Australia whose hobby is to hunt supernovae. The second chapter, called "The Size of the Earth", is about the attempts to measure the size and weight of the planet Earth, as the title might suggest, but it also covers the birth of the field of geology, important discoveries in paleontology, and chemistry.

[3] In the *Short History*, Pluto is still defined as a planet because the book was written before the International Astronomical Union (IAU) decided to redefine Pluto as a dwarf planet in 2006.

The third chapter, "A New Age Dawns", focuses on Einstein, atoms, quarks and the plate tectonics while chapter four, "Dangerous Planet", covers natural disasters such as volcano eruptions and earthquakes. A subchapter is also devoted to the supervolcano lurking beneath the Yellowstone national park and what the consequences might be if it suddenly erupted. Chapter five, "Life Itself", focuses, as the name might suggest, on the evolution and destruction of life, the theory of Charles Darwin, and the composition of atmosphere. In other words, this chapter covers everything that has contributed to making it possible for life to evolve in this planet. The final chapter, "The Road to Us", deals with the evolution of *Homo sapiens* and some of the extinctions caused by human actions (most notably the dodo and Tasmanian tiger).

Some of the chapters focus on the past and the discoveries made in the 18th, 19th and 20th centuries, while others deal with the modern day and often feature Bryson himself going "out in the field" and meeting scientists, researchers and science enthusiasts in person. An example of such an encounter is when he visits the Yellowstone National Park and speaks with Paul Doss, a geologist working in the park. Doss takes him on a tour around the park and tells him some interesting facts about it – for instance, that there are more geysers and hot springs at Yellowstone than in the rest of the world combined (Bryson 2004: 288).

Most importantly, however, they discuss about the supervolcano underneath the park and what would happen if the volcano suddenly erupted. Bryson is particularly interested whether there would be any warning about an impending eruption. However, Doss can only give him vague guesses because the last eruption was over 600,000 years ago. He explains that earthquakes and changes in the geyser eruption patterns might indicate something is about to happen, but there are hundreds of earthquakes at Yellowstone every year and geysers are by nature unpredictable. Bryson learned that there are other hazards in the park, some of them more likely than others. The reason for Bryson to include such natural disasters in the book is that the particular chapter dealt with the dangers our planet poses. My personal belief is that this chapter was included partly because of people's fascination with dangerous phenomena and partly because it attempts to alleviate the fears some may have about the eruption of the Yellowstone

supervolcano, for example. Another point to include this chapter is Bryson's desire to show to the reader what scientists and researchers do on a daily basis and thereby alleviate some of the myths surrounding scientific work.

Because the translated version *Lyhyt historia lähes kaikesta* (first published in 2005 by Werner Söderstöm Osakeyhtiö WSOY) does not deviate from the structure of the original, I will focus, instead, on the translator. Markku Päkkilä, a renowned Finnish translator, studied at the University of Joensuu and has worked as a freelance translator since 1990 (LinkedIn 2015). In 2006, he was awarded the J. A. Hollo award for a high-level Finnish translation of a non-fiction book, namely *Lyhyt historia*. Distributed since 1991, the award is rewarded to a translator who has made either an outstanding translation of a challenging science publication, or, alternatively for a long, laudable career in science translation (The Finnish Association of Translators and Interpreters SKTL 2014). The jury for this award justified their decision by pointing out that not only did Päkkilä have to find specialized terminology for several different fields, but he also maintained the compelling style and humor of the source text. (Turun Sanomat 2006.)

Bryson's *Short History* was a critical success. For instance, in his review for *The Guardian*, John Waller, research fellow at the Wellcome Trust Centre for the History of Medicine, praised Bryson for his quirky prose and was impressed by the coherence and range of the book (Waller 2003). Waller found the tidbits about eccentric scientists sprinkled throughout the book entertaining (ibid.). Conversely, John Dupuis, Science Librarian at Steacie & Engineering Library at York University, disagreed and claimed that Bryson's attempt to find "unsavory gossip" about scientists mentioned in the book was taking the "humanization-of-science" too far (Dupuis 2010). In Finland, *Lyhyt historia* was also well received; in a review for *Helsingin Sanomat*, Jyrki Alenius found the book entertaining and readable (Alenius 2005). However, astronomer Hannu Karttunen was of the opinion that the credibility of the book was compromised since several small mistakes were found in the section focusing on space and the solar system (Karttunen 2006). In brief, as can be deducted from these rather differing opinions, popularization of science causes a lot of controversy.

1.2 Method

In this section I will discuss case study, heuristic evaluation and interview as research methods. The method of my thesis consisted of a textual analysis, complimented by a small interview with translator Markku Päkkilä conducted via LinkedIn. The interview was intended to support the textual analysis and provide additional information. This was a qualitative research; no statistics were used in this MA thesis. Instead, I focused on studying the meanings and backgrounds of the material and the interview was used to shed light on some of the translator's choices. This way, I did not have to exclusively make presumptions of the translator's intentions. However, it should still be stressed that the analysis is mostly based on my own interpretation of the subject.

Although making generalizations about the subject was not my primary aim, it should be noted that even case studies may reveal something that is applicable on a more general level (Hirsjärvi, Remes & Sajavaara 2009: 182). When a case study is conducted carefully enough, the themes which may occur in other similar cases will emerge. However, Hirsjärvi et al. stress that generalization cannot be made directly from the material. (ibid.) Generally case study is chosen as a method when the aim of the research is to gain deeper knowledge of a certain subject and to understand the context surrounding that subject (e.g. the background) (Saaranen-Kauppinen & Puusniekka 2006a). It is also important to ponder how the results that the case study yields could be used in other similar studies and what other studies could benefit from those results. In addition, it is worth keeping in mind that the results, while applicable only to the study at hand, could be used while planning a more extensive research on a similar subject. (ibid.) While both quantitative and qualitative methods can be used in a case study, qualitative methods are more commonly favored by the researchers, unless the material consists solely of quantitative data (ibid.).

As was stated in the beginning of this section, the analysis was based on my own interpretation of *Short History* and *Lyhyt Historia*. Jakob Nielsen claims that a single analyst is unlikely to spot all usability problems (Nielsen 1995). While some of the

usability problems are so obvious that any analyst can spot them, some other problems tend to be found only with the help of additional analysts. Nielsen further argues that "one cannot just identify the best evaluator and rely solely on that person's findings". (ibid.) There are two reasons for this. Firstly, the same person will not be the best evaluator every time and secondly, evaluators who do not find many usability problems have been known to spot some of the more elusive problems. (ibid.)

This kind of usability problem identification is known as *heuristic evaluation*. While generally used as a *usability engineering* method for evaluating user interface designs (Nielsen 1995), it has also been adapted for evaluating texts, mainly technical documentation (Suojanen, Koskinen & Tuominen 2012: 102). When evaluating the usability of documentation, heuristics developed for such purpose focus on assessing how well the documentation in question help a user reach his or her aims. In order to assess if the documentation is indeed usable, the evaluator may use the following points as a guideline. The language and terminology of the documentation should be familiar to the user and the text should proceed in a logical manner. Moreover, the content of the text should be structured logically and information should be found without difficulty and it should also be easy to understand. In addition to this, the documentation should also take into account that different users seek information in different ways. (ibid.)

In this thesis, I am the sole analyst. Since Nielsen recommends using 3-5 analysts (Nielsen 1995), it is therefore highly unlikely that I will be able to spot every usability problem in the material I have chosen. This is based on Nielsen's projects in which it was found that a single analyst is able to find approximately 35 per cent of all usability problems (ibid.). However, I argue that this is enough for my purposes for three reasons. Firstly, since this is an MA thesis, the scope is limited and thus being able to limit the scope is vital. Secondly, the additional analysts would most likely have to be familiar with either the material of this thesis or popular science literature in general in order to be able to effectively conduct a heuristic evaluation. Finally, conducting a heuristic evaluation on the *Short History* or another popular science book with the recommended three or more analysts could be a subject for a future research.

As previously mentioned, in order to increase the credibility of the research I supplemented the heuristic evaluation by conducting a brief interview with the translator Markku Päkkilä. Since the interview was a supportive method, I will cover it only briefly.

Interview is one of the most commonly used ways to gather material for analysis (Saaranen-Kauppinen & Puusniekka 2006b). Unlike in an everyday conversation or in a newspaper interview, research interview has only one goal: answering the research question. It is expected that the interview is used to gather material which will then be analyzed and interpreted in order to find answers to the one or more research questions the researcher has set for the study he or she is conducting. (ibid.) There are several different types of interviews available. One of the most commonly used classifications is based on how structured the interview is. (ibid.) In other words, interviews are classified by whether there is a particular order in which the interview questions are posed and how freely the interviewee can answer the questions. A more precise way to classify interviews is to divide them into *structured*, *semi-structured* and *unstructured interviews* (Gill, Stewart, Treasure & Chadwick 2008: 291). Structured interview, as the name suggests, follows a predetermined pattern; the researcher asks the same questions from all interviewees and presents them the same choices for answers. There is no follow-up on questions. (ibid.) Conversely, unstructured interviews do not follow any predetermined pattern. The researcher conducting the interview may have one starting question, but from thereon, how the interview will progress depends on how much the interviewee shares with the researcher. (ibid.) The researcher may subtly lead the conversation back to the subject of the interview or they may ask the interviewee to clarify something he or she said (Saaranen-Kauppinen & Puusniekka 2006c). However, unstructured interview resembles closely an ordinary conversation and progresses mostly on the interviewee's terms (ibid.).

Semi-structured interview resembles both the structured and the unstructured interview. While the researcher has several key questions, the interviewee may answer them freely and the researcher has a chance to ask for clarifications or more details. (Gill et al. 2008: 291.) Additionally, while the interviewees are free to diverge from the questions

presented to them to pursue a subject they feel is important, the key questions may offer them guidance in what to talk about, which many, according to Gill et al., find helpful (ibid.). Since semi-structured interview provides some flexibility compared to the structured interview, it is possible to discover information which the researcher may not have previously thought of (ibid.).

It is generally assumed that when a researcher wishes to find out something about people's lives, the wisest course of action is to ask from the people themselves (Saaranen-Kauppinen & Puusniekka 2006b). However, it should be noted that while interview is a useful method to gather material, it is not without its flaws. A researcher conducting an interview must take into account the possible problems which may occur. One example of such problems is the researcher phrasing a question poorly and thus causing the interviewee to misunderstand the question. Another example is an interviewee withholding information or telling something the interviewee assumes the researcher wants to hear. Thus the answers may provide the researcher false results. In addition, it should be carefully pondered if an interview is the best choice of research method for a particular research or would another method, such as a survey, yield better results (ibid.).

The interview I conducted with Markku Päkkilä[4] was a semi-structured interview. While I sent several predetermined questions to him, Päkkilä was free to answer them the way he saw the best. Moreover, I had the chance to send him additional questions should I have deemed it necessary. As it stands, I received enough information on my initial interview round. Traditionally interviews have been held with researcher and interviewee meeting face to face. I, however, believed it was enough to conduct the interview via LinkedIn because I intended the interview to be a supplementary method.

[4] I would like to extend my warm thanks to Markku Päkkilä for helping me conduct this research.

1.3 Historical reactions to popularization

In this section, I will briefly discuss historical reactions to popularization. Today, the subject of popularization arouses several vastly different opinions (see chapter 3 of this thesis for further information). Historically, however, popularization has been seen as synonymous to school and college education (Downs 2010: 448)[5]. There was no separation between production and reproduction of knowledge; instead, anyone identifying themselves as a geographer engaged in both producing scientific knowledge and popularizing it. It was only in the beginning of the nineteenth century that there were any lines drawn between production and reproduction. (Downs 2010: 448.) However, as Tim Blanning, the former Professor of Modern European History, writes, the word 'science' did not come to mean the natural sciences until the nineteenth century; indeed, earlier it meant nothing more, nothing less than 'knowledge' (Blanning 2008: 473). He continues that during the seventeenth and eighteenth centuries, scientists dabbled with not only with physics, but also with philosophy, mathematics and theology (ibid)[6].

To provide an example, during the eighteenth and nineteenth centuries, many of the great discoveries made in geology (and indeed, the creation of the science known as geology) were not made by scientists in pristine laboratories with precise equipment; instead, they were made by amateurs with time and money in their hands. One such person was Charles Lyell, who was born into a wealthy Scottish family and whose *The Principles of Geology* (first published in 1830) influenced geological thinking well into the twentieth century (Bryson 2004: 99). Lyell was greatly influenced by James Hutton, another Scottish "gentleman scientist" and the father of geology (ibid. 91), yet he admitted he could not read Hutton's work *A Theory of the Earth with Proofs and Illustrations*, since the book, published in 1795, was frankly incomprehensible (ibid. 94). Luckily for Hutton and for geology, mathematician John Playfair from the University of Edinburgh published in 1802 *Illustrations of the Huttonian Theory of Earth*, a

[5] Downs is speaking in the terms of popularizing geography, but his statements can easily be applied to all forms of popularization.

[6] Indeed, every scientist of the seventeenth century worth mentioning believed in God, and even justified the investigation of this world with their belief in the existence of the world beyond (Blanning 2008: 470).

simplified version of Hutton's theories (ibid. 94). No doubt Playfair's version could be classified as a popularized text.

Historian Tim Blanning further points out that it was not even expected that everyone would be able to understand the great minds such as Newton or Descartes and therefore there were plenty of popularizations available (Blanning 2008: 473). A good example of a highly successful popularized book, *Astronomy Explained upon Sir Isaac Newton's Principles, and Made Easy to Those who have not studied Mathematics* by James Ferguson, was first published in 1756 and subsequently reprinted seven times (ibid.).

The widening of the public sphere and the rising literacy rates in the eighteenth century meant that more books had to be printed. As stated above, the works of the "great minds" were made available to the public by writing a popularized version of them, especially in the form of novels. Yet the intelligentsia of that era was against this change; "less is better" was their opinion. (Blanning 2008: 482.) Many scientists believed that science ought to remain "pure" (Downs 2010: 448) and nothing demonstrates this better than the words used for popularization in several European languages, the French word *vulgarisation* being the prime example.

In her paper "Spreading Chaos: The Role of Popularization in the Diffusion of Scientific Ideas", Danette Paul argues that the "gentlemen scientists" mentioned above, that is the amateurs, influenced greatly the emergence of scientific thinking and were also important in advancing critical thinking that is so essential to the scientific community (Paul 2004: 34). According to Paul, in the nineteenth century it was still possible for popularized science to have an effect on the "proper" science, but during the following century "the motive for [contributing to science] was becoming increasingly suspect among scientists" (ibid. 35). Bernadette Bensaude-Vincent writes that the

> notion of a popular science as a science distinct from that of the professional scientists is no longer acceptable. Any non-professional practice of science that is not shaped and constrained by the current norms and regulations of the

> academic community is labeled a pseudo-science. There is no alternative science. Science is unique. (Bensaude-Vincent 2001: 106.)

She continues that the change, first from popular science to science popularization and further to science communication, demonstrates that the way the public has been viewed has changed. Gone is the enlightened amateur of the eighteenth century; in its place is the dumb mass that believes everything it is told. (Bensaude-Vincent 2001: 106.) Opinion has come to be viewed as the antithesis of knowledge for it is based on "prejudices, immediate and premature answers, and naive realism" and opposing it is "both an intellectual and ethical enterprise" (ibid.). In other words, the way scientists think is good and public opinion is bad, even despicable.

The distrust, even hatred, of popularization can be seen vividly in the reception of a popularized geography book. *Van Loon's Geography*, written by the Dutch-born Hendrik van Loon and first published in 1932, was highly popular, selling more than 150,000 copies within the first four months (Downs 2010: 453). The media gave it positive reviews but geographers regarded it with distain, claiming no one above the age of twelve could ever find the book appealing. They also criticized the book for addressing not only geography, but also, in a true seventeenth century fashion, sociology, history, economics and philosophy. (ibid. 458-459.)

Van Loon did not want to fill his book with names the reader was bound to forget in an instant, and acknowledged his limitations; because the number of pages was limited, the description had to be brief and the amount of details cut short (Downs 2010: 455). Whereas the reviewers were of the opinion that van Loon's mixture of history and geography was a success, the geographers felt differently. They also disagreed with the reviewers on the content, being horrified that van Loon had used a globe-shaped pencil-sharpener instead of a proper globe. Equally horrifying was, apparently, the fact that four saucers had been used to describe the geography of Paris. (ibid.) While the geographers reproached van Loon for the erroneous facts, the reviewers noted that while he was undoubtedly a clever wordsmith, at times he could have worded his sentences better (ibid. 461). However, the general opinion was that the style in which the book

was written was captivating and engaging and it might help to make geography more appealing to the masses (ibid. 455).

The reason I chose to draw attention to Van Loon is that there are many parallels between him and Bryson, despite there being seventy years between the publications of their respective books. The first parallel is in the titles; both are highly ambitious, one being named after the author, claiming that it is his view of geography, and the other claiming that it is possible to cram the history of nearly everything in less than 600 pages. Both have also received criticism for their choice of titles, the critics claiming that especially the title of Bryson's book is misleading, since it covers only a small portion of natural history and thus is not a history of "nearly everything" (Dupuis 2010). The second parallel is that neither Van Loon nor Bryson is a scientist. Van Loon was a historian and Bryson is renowned for his travel books. Both have been reproached for writing books about science because they are amateurs: it is simply not possible for amateurs to understand enough about the subject and they are, therefore, liable to get things wrong.

Is there any kind of conclusion that can be drawn from this short historical overview? Only one, perhaps, but I feel it is the most important one. The obvious conclusion is that the reaction to popularization has been ambivalent. On one hand, popularization has been viewed as necessary, since not everyone can understand the complex theories. Even so, everyone should have the opportunity to familiarize themselves with such theories. On the other hand, scientific knowledge has slowly come to be viewed as the only "true" form of knowledge; the rest is simplified and often incorrect blabber and thus more than suitable for the ignorant masses.

As we will see in section 4.3, many view popularization as a lesser form of science, or even as borderline pseudo-science. Moreover, popularized books by non-scientists such as Hendrik van Loon or Bill Bryson are regarded with suspicion because such endeavors increase the odds that the work will be riddled with amateur mistakes and dubious sources which might even be quoted incorrectly. Therefore, many feel that popularization should be left to scientists, but only if they are more or less retired from

active research. This brings us back to the notion of popularization being lesser than “real” science.

2 "PRODUCTIVELY, EFFECTIVELY AND COMFORTABLY": AN OVERVIEW OF USABILITY, WITH PARTICULAR FOCUS ON AUDIENCE DESIGN

In this chapter, I shall delve more deeply into the theoretical framework of this thesis. To be more specific, this chapter discusses usability, focusing particularly on audience design. The second part of the theoretical framework, popularization, will be discussed separately in chapter 3. There are two sections in chapter 2: the first section covers the subject of science translation and how, if at all, it has changed over the centuries while the second section discusses usability. Usability and popularization are both used as the theoretical framework because I feel that using only one of them is not enough to analyze all of the features that I have chosen to include in this thesis. Conversely, relying on both usability and popularization as my analysis framework allows me to analyze the features from a much wider perspective and possibly contribute something new to the studies of popularization and usability.

2.1 Scientific translation

As Scott L. Montgomery, geologist and independent scholar, notes translating science is as old as science itself (Montgomery 2010: 299). Since more and more nations, organizations and institutions have become users of scientific knowledge, translation plays an integral part in spreading this knowledge (ibid.). Yet there is a curious belief that science translation is an unimportant literary event – Montgomery likens this to the passing of coins from one hand to another (Montgomery 2000: 253). Such reasoning is based on another belief, one that states that science is a universal language. To prove his point, Montgomery mentions mathematics – surely something that is composed mostly of figures and symbols could be viewed as truly universal? Montgomery, however, argues that since each symbol must be first defined linguistically, the symbolic system would be meaningless without written instructions. (Montgomery 2000: 254-255.) Therefore it can be argued that even mathematics is not a universal language.

Another argument against science being a universal language can be found in the translation of medical articles. Morten Pilegaard points out that in the late 14th and early

15th centuries medical translation was relatively easy since the progress in medical science was much slower than today. Moreover, some of the features of medical communication, such as the anatomical and physiological concepts, were more or less the same all over the world. (Pilegaard 1997: 161.) Today, however, medical science advances much faster than it did 500 years ago. Pilegaard notes that although Latin used to be the language of international medical communication, English has now taken its place. Pilegaard further argues that

> English is the international language of science and technology *per se*, and as technology is a growing subset of medicine, any medical translator hence increasingly relies on his mastery of the English language for the acquisition and dissemination of knowledge about medical subject field, which, to a large extent, has come to include chemistry, electronics and statistics, among others (Pilegaard 1997: 162).

In addition, Pilegaard points out that medical translators must also take into account that certain concepts have no equivalents in certain languages. As an example of such a concept, Pilegaard mentions *shin* which has no equivalent in French and *knuckle* which has no equivalent in either French or German. Furthermore, new names and new terminology are being coined daily, which increases the need for exchanging information. (Pilegaard 1997: 162.) In fact, Pilegaard claims that

> medical translators may run into the problem that there is no such thing as a systemized knowledge of the syntactic, semantic and pragmatic limitations of medical terminology because specialized registers in general and medical terminology in particular undergo constant innovation, adaptation and change (Pilegaard 1997: 162).

Taking into account the arguments above, it can be claimed that, like mathematics, medical science is not a universal language today even though it might have been regarded as such in the fifteenth century.

There is also the matter of English being regarded as the lingua franca of the scientific discourse. Montgomery even mentions that some regard English as the “new Latin”, for it is the most widely used language in, for instance, technology and by science and

engineering students (Montgomery 2000: 256). Pilegaard, too, mentions it being the "international language" of science and technology (Pilegaard 1997: 161). However, it ought to be remembered that in the 17th and 18th centuries Latin was not, contradictory to the popular belief, the most commonly used language in sciences. The rapid spread of literacy and the emergence of nation-states strengthened the use of the vernacular languages. Moreover, during the Renaissance classical Latin had been strongly favored, which made learning the language much more difficult and caused the sales of Latin books to decline. This led to Latin losing its earlier hegemony in the scientific discourse. (Montgomery 2000: 300.)

By the late 17th century, much of the scientific literature (e.g. journals, monographs and books) were written in vernacular languages in most of the European nations. This meant that the works written during the Scientific Revolution had to be translated from one language to another. (Montgomery 2010: 300.) Nowadays, however, we are facing a completely different situation. Montgomery points out that scientific work is being shared with academic institutions, governments, non-government organizations (NGOs) and corporate research centers on different continents, and an increasing number of international treaties involve directly scientific subjects. (ibid. 301.)

Yet why was it English and not French or German that rose to the dominant position? Often the influence of the British Empire or the ubiquitous American pop culture is cited as a reason, but Montgomery is of the opinion that it is not enough. Instead, he believes that the reason can be found in the Scientific Revolution of the seventeenth century which was further amplified by the Industrial Revolution. (Montgomery 2009.) For a while, French and German posed a threat to the hegemony of the English language, but, as Montgomery points out, they were late-comers and after the Second World War were overshadowed by the emerging American science (ibid.).

Montgomery also draws attention to the fact that there is no single English language that all scientists and researchers could use; instead there are many different forms of English and all of them have their unique characteristics (Montgomery 2000: 256). In fact, he argues that nowadays it is impossible to speak of a "world English". Rather, it

should be “world Englishes”. (ibid.) In some cases, the English language may develop into a localized form of English (LFE) (Strevens 1992: 34 in Montgomery 2000: 256). Montgomery makes two points about the usage of “world Englishes” and LFEs. The first is that the English language only prevails in some fields, such as biology and physics, whereas in chemistry and mathematics local languages are often used. Moreover, Montgomery claims that in some countries, for example Germany and Japan, researchers in certain fields[7] publish papers written in their own language. (ibid. 257.)

The second, more important point is that the grammatical, syntactical and lexical norms of scientific English vary from one LFE to another, thus making any claims about standardized scientific discourse invalid. In addition there is discrepancy between the terminological standardization used in different scientific fields, even in the English language. (Montgomery 2000: 257.) These different Englishes then invariably result in different sciences, each of which has been constructed to suit the needs of different cultures. (ibid.)

There has been some concerns that the spread and usage of the “world Englishes” in science means that other languages will be gradually replaced completely by the English (Montgomery 2009). In Finland, the Finnish Language Board (Suomen kielen lautakunta in Finnish) of the Institute for the Languages of Finland issued in 2010 an appeal to all universities to preserve the usage of Finnish as a scientific language and encourage researchers to publish papers in Finnish and Swedish and not only in English (Institute for the Languages of Finland 2010). Montgomery, however, points out that the dominance of a single language means that occasionally scientists and researchers publishing in a different language do not receive the attention they deserve. Moreover, scientists themselves view English not as an obstacle, but as an opportunity. Montgomery argues that “linguistic nationalism” is absurd when “the final aim of any scientific work is to share its results with as much of the (ever-more globalised) disciplinary community as possible”. (Montgomery 2009.) In support of Montgomery’s argumentation, Alejandro Bortulus notes that many non-native English speaking (non-

[7] Montgomery does not further specify what these fields are.

NES) scientists feel pressurized to publish articles in high-impact peer-reviewed English-speaking journals (Bortulus 2012: 769). Moreover, the works published by non-NES researchers in their native languages are commonly regarded as "gray literature" and many international, English-language journals discourage references to such works (ibid.: 770).

When Montgomery discussed the above issue of language choice with scientists, they provided the following points in favor of publishing in English. While they accept that writing about science in one's own language must be encouraged, they also point out that learning English is always an asset. This way scientists can read papers published in their field of study directly after they are published and do not have to rely solely on translations. (Montgomery 2009). Learning English is not easy, but the scientists Montgomery has spoken with point out that once the language has been mastered, it brings many possibilities and makes one a part of an international community (ibid.). Nevertheless, Montgomery is of the opinion that it would be a great shame if all science would be written in just one language. Therefore he feels that translation is important in maintaining both the source language and the target language. (ibid.) Meredith Root-Bernstein and Richard J. Ladle agree with Montgomery and propose that universities or departments hire professional translators with a background in science to help researchers to translate their works from or into English. Alternatively, the authors suggest offering positions to bilingual researchers and earmarking a certain percentage of their time to helping their colleagues. (Root-Bernstein & Ladle 2014: 832.)

2.2 Usability and audience design

In this section I will discuss usability and one of its subcategories, audience design. As was noted in the beginning of this chapter, usability was included in my research because with it, I can analyze the material I have chosen from a wider perspective. As will be seen later in this thesis (see, for instance, subchapter 4.1), usability and popularization have similar qualities. I will begin this subchapter by outlining the different definitions of usability and how those definitions vary from each other. From there I will move on to Allan Bell's theory of audience design. As one source for this

section, I used Tytti Suojanen, Kaisa Koskinen and Tiina Tuominen's book *Käyttäjäkeskeinen kääntäminen* [User-centered translation] (2012) which also discusses usability in detail.

Suojanen, Koskinen and Tuominen define *usability* as something that can be used "productively, effectively and comfortably" (Suojanen, Koskinen & Tuominen 2012: 15). In other words, it is something that users (in the case of *Short History* and *Lyhyt historia*, the readers) find not only easy, but also enjoyable to use. However, it is important to note that usability is dependent both on the situation and the user in question (ibid.). In translation studies, user-centered translation refers to the process of gathering information about the users during the translation process and adjusting the communication situation based on the gathered information (ibid.).

Traditionally, usability research has focused on the interaction between humans and computers, as well as on the usability of different IT interfaces (Suojanen et al. 2012: 16). Usability has no one agreed-upon definition; instead, the definition depends heavily on each researcher's own starting points. For most people, however, usability means something that is easy to use or operate. (ibid.) According to one definition, usability is a component of *acceptability*; in other words, the system must fulfill the criteria set by different interest groups. Acceptability is further divided into functional and social acceptability, which means that even though a system is usable in function, it might not meet the criteria of social acceptability (e.g. it might be considered to be discriminatory). (ibid.)

The primary idea of usability can be summed up by saying that there is a *product* and its *user* (Suojanen et al. 2012: 26). However, with texts one must ponder whether a text can be a product and whether the reader can be called a user (ibid.). Suojanen et al. point out that very few of us would prefer to be called users for the term is vague and can have negative connotations. In addition, user as a term may be limiting since it may not cover every possible way to use a particular product. For example, a computer can be used for many different tasks such as gaming or writing a work report. (ibid.) Yet a user has been defined as someone who "installs, uses, adjusts, cleans, maintains, repairs,

transports or disposes of a product" (Euroopan integraatio 1996: 5 in Suojanen, Koskinen & Tuominen 2012: 26). Thus, no user exists in a vacuum; instead, the term *user* includes the notion of interaction with the product in question. (Suojanen et al. 2012: 26-27.)

Suojanen et al. point out that there are five points which support the notion that some texts, such as manuals, fit the definition of a product. Firstly, the definition mentioned above comes from a publication discussing manuals. Secondly, manuals are an integral part of a product and thirdly, Finnish law also demands that every product should be equipped with a manual[8]. Fourthly, in technical communication there are terms such as *communication information* and *communication products* which refer specifically to manuals and other similar texts. Finally, technical documents are first and foremost *utility texts* or *necessary texts*. (Suojanen et al. 2012: 27.) If a document is classified as a utility text, it is meant to be used for some concrete purpose (e.g. to fix a broken machine) and not to be enjoyed (ibid.).

Suojanen et al. extend their ideas of usability to also include novels, poetry, dramas and other fiction (Suojanen et al. 2012: 34). Based on their argumentation, I consider Bryson's *Short History* a product. Although, admittedly, the book is not meant to be used the same way as a manual, it is nevertheless meant to be enjoyed. In fact, Suojanen et al. point out that a reader may well use a book to enjoy its beautiful language or merely to relax (ibid.). It is also often said that people read (that is, use) books to travel to faraway places, sometimes real and sometimes imaginary. Readers also use books to widen their view of the world or to search for information about events that happened in the past.

It can, therefore, be argued that fiction can be used. This is particularly true when we begin to examine non-fiction books. After all, non-fiction books, regardless of whether or not they are popularized, are used to *obtain information* about a specific subject. In

[8] Kuluttajaturvallisuuslaki [Law for consumer safety] 920/2011 § 9, Valtioneuvoston asetus kulutustavaroista ja kulutuspalveluksista annettavista tiedoista [Finnish Government degree for information to be given about consumer goods and services] 613/2004, Kuluttajansuojalaki [Law for consumer protection] 38/1978 luku 5 12 a §

the case of Bill Bryson's book the subject that readers want to find out more about is the planet Earth and how we can gain more information about its features and phenomena in general.

In the context of literature, while the term *user* is generally utilized, I have also applied the term *reader* to offer some variation to the text. *Readability* is the term used for measuring a book's usability (Suojanen et al. 2012: 35). We cannot deny the fact that if a book is readable, it is also easy for the reader to use. However, as Suojanen, Koskinen and Tuominen point out, it would be wrong to assume that a readable book would also automatically be usable (ibid.). For instance books with only main clauses and short sentences may be readable, but they are not enjoyable and the cohesion suffers from the monotonous rhythm (ibid.).

This being the case, the term *comprehensibility* is better suited for the evaluation of the usability of literary works. Besides, since comprehensibility is suitable for examining the communication function of a text, it is therefore better suited for the purposes of translation studies (Suojanen et al. 2012: 35). However, even the most readable and comprehensible text may not be the most usable; other criteria are also required: the text must be encompassing, the content accurate and it must correspond to not only its function but also to all legal criteria set to it (ibid.).

Usability is an umbrella term which covers several other theories. One of them is *audience design*, an integral part of usability theory created in the 1980's by Allan Bell. Originally created for sociolinguists to record style shift in speech, Bell's theory states that the *speaker* (also called the first person) will always modify their speech to suit their hearers' needs (Bell 1984: 159). The speaker also assigns roles to hearers and often their physical distance from the speaker gives away their position (ibid. 160). An individual speaker modifies his or her speech in any given situation based on whether the hearer is classified as a second or a third person. How much influence the hearers have over the speaker's modification depends on whether they are known, ratified and addressed by the speaker. (ibid.)

The second person, termed by Bell as the *addressee*, has the most influence since they are not only known and ratified but also directly addressed by the speaker. Other possible hearers are the third persons, and their influence depends on how aware the speaker is of their existence. None of them are directly addressed. (Bell 1984: 159.) Of these third persons, the *auditors* are both known and ratified by the speaker but not addressed, as stated earlier. However, since they are known to the speaker, they exert some influence over the speaker's style shift. (ibid.) Less likely to have any influence over the style shift are the *overhearers* and *eavesdroppers*. The overhearers are the persons that the speaker knows to be there but they are not addressed nor ratified. In contrast, the eavesdroppers are not known to the speaker at all. (ibid.)

In a paper written in 2001, Bell reflects on the theory he created in the 1980's. He points out that he himself has avoided calling audience design either a theory or a model. However, he believes that nowadays such terms are not as much an overstatement as they would have been when the concept of audience design was first created. (Bell 2001: 141.) Upon rereading the paper he wrote in 1984, Bell took notice of the "bold hypotheses and predictions" in it (ibid.). He still essentially agrees with what he wrote almost twenty years ago; however, Bell feels that there are a few points in need of a modification. As an example he names some of the hypotheses and predictions which were "consciously stretching the boundaries at the time" and some he now finds "questionable". (ibid.)

All in all, audience design can be summarized in ten points. Firstly, style can be defined as what "an individual speaker does with a language in relation to other people" (Bell 2001: 141). In other words, 'style' refers to how a person speaks to another person. Secondly, the meaning of style is derived from the linguistic features used by a particular social group (ibid. 142). Thirdly, speakers are never confined to a single style; they always vary their style in response to their audience (ibid. 143). Fourthly, audience design does not apply to only one code or level of language repertory, but to all of them. Bell emphasizes that whether these codes and levels are monolingual or multilingual is not an issue. (ibid. 144.)

Fifthly, variation in style derives from, and also "echoes" the social dimension of speaking (Bell 2001: 145). This means that style variation is both diachronic and synchronic, i.e. it is affected by both the historical origin and the modern form of styles (ibid.). Sixthly, each individual speaker is able to change their style in response to a range of different hearers at will (ibid. 146). Seventhly, whenever style shift happens due to a certain topic, the meaning of that topic is defined by the underlying association of certain topics with certain audiences (ibid.). Eighthly, in addition to style shift being the result of a change in a situation, style shift can sometimes trigger such a change (ibid.). Ninthly, these "initiative style shifts" are believed to be "referee design", which means that by shifting one's style to match the style of the group the other person represents one shows identification with that group (ibid. 147). Finally, Bell argues that style research needs its own designs and methods (ibid. 148).

As I stated earlier, Bell mostly agrees with the earlier framework he created. However, there are a few points he does not agree with anymore. In his opinion, the problems lie with the points eight and nine summarized above (Bell 2001: 163). The reason is, he believes, that it is difficult to consider a person's "dynamic, initiative use of style [...] to express aspects of their identity [...] while retaining a worthwhile level of generalization" (ibid.). Bell notes that the main risk with frameworks such as audience design is that they may underestimate the complexity of a speaker's use of language which is, by definition, self-expressive and changing every moment (ibid. 163).

How can this, then, be applied to my material? According to Suojanen, Koskinen and Tuominen, the role of the speaker can very well be assigned to the writer (Suojanen et al. 2012: 65). Audience design can be used to analyze all levels of any communication situation. Suojanen at al. points out that the main idea of translation is to decide what will be translated and to what languages it will be translated to. These two points alone can be used to define the addressees and the auditors simply because the ability to understand a certain language is vital for receiving the message in the first place. (ibid.) Furthermore, from the point of view of a translator, the use of audience design can help to limit the target group for certain translations (ibid.: 67). Since a translation is hardly ever aimed at a single, known addressee, the target group may appear to be a faceless

mass. Thus audience design can help to identify the primary addressees and how to best modify the content to better suit the needs of those addressees. (ibid.)

3 A MODERN DAY PERSPECTIVE ON POPULARIZATION

In this chapter I delve into the subject of popularization. This chapter only focuses on the current issues of popularization as I have already discussed the history of popularization in section 1.3. This chapter also includes examples from the material where they are relevant. Both the source text and the target text versions are included in the example and are preceded by ST and TT, respectively.

The term 'popularization' covers a vast array of different discussions, and as Greg Myers further points out, the definition of the scope of the field depends on what the field is *not* (Myers 2003: 265, my emphasis). As an example, Myers mentions that an article published in the *Cell* magazine does not belong in the field of popularization. However, if a science journalist writes a report about the same article for *The Times* then it can be viewed as popularization. (ibid.) The definition I will be using in this thesis is the one set by Helena Calsamiglia and Teun A. van Dijk from the Pompeu Fabra University. According to them, popularization is

> a vast class of various types of communicative events or genres that involve the transformation of specialized knowledge into 'everyday' or 'lay' knowledge, as well as a recontextualization of scientific discourse, for instance, in the realm of the public discourses of the mass media or other institutions (Calsamiglia & van Dijk 2004: 370).

In other words, popularization is about making academic and scientific texts understandable to the general public. It does not, however, aim to make the text more popular – that is, more liked – as Min-Hsiu Liao notes in her article (Liao 2013: 130). Moreover, popularization is not aimed only at the members of the lay audience; researchers from other disciplines and students within the said discipline are also important target groups for popularization (Kiikeri & Ylikoski 2004: 189). The only difference between these two groups and the general audience is the forum in which the information is published and how much previous knowledge can be expected from them (ibid.).

Kiikeri and Ylikoski also point out that popularized texts are rarely aimed at the entire lay audience itself: the real audience is the "representatives" of the lay audience such as politicians and corporation executives (Kiikeri & Ylikoski 2004: 189). In addition, considering the entire general public as the audience can be problematic and therefore popularization is aimed at a small group within the public (e.g. amateur scientists) who have a 'motive' of sorts to wish to know more about something (ibid. 190). If we examine the *Short History*, we notice that some previous knowledge about the subject is expected, although Bryson does his best to explain some of the more difficult themes in the book. However, I believe the amount of knowledge comparable to a Finnish high school syllabus is enough to understand the basic concepts of the book since Bryson's aim is to make the information the book presents more widely available. To support my claim, I point out that Markku Päkkilä used high school text books as source material while writing the translation of the *Short History* (Päkkilä 2015). He also finds the level of the information presented in the book comparable to that of high school, although the way in which the information is worded in the book flows much better than in an average textbook (ibid.). Consider this quote:

(1) ST: It isn't simply that we can't breathe in water, but that we couldn't bear the pressure. Because water is about 1,300 times heavier than air, pressures rise swiftly as you descend – by the equivalent of one atmosphere for every 10 metres of depth. On land, if you rose to the top of a 150-metre eminence – Cologne Cathedral or the Washington Monument, say – the change in pressure would be so slight as to be indiscernible. At the same depth under water, however, your veins would collapse and your lungs would compress to the approximate dimensions of a Coke can. (Bryson 2004: 295–296.)

TT: Kyse ei ole vain siitä, ettei ihminen voi hengittää vedessä, vaan myös siitä, että veden paine on meille liikaa. Koska vesi on lähes 1300 kertaa raskaampaa kuin ilma, paine nousee syvyyksiin laskeuduttaessa nopeasti – yhden ilmakehän verran jokaista kymmentä metriä kohti. Jos kiipeämme maan pinnalla 150 metrin korkeuteen – vaikkapa Kölnin tuomiokirkon torniin tai George Washingtonin muistomerkin huipulle – paine muuttuu niin vähän, että sitä tuskin huomaa. Mutta jos laskeudutaan yhtä syvälle veden alle, verisuonet painuvat kokoon ja keuhkot puristuvat suurin piirtein virvoitusjuomatölkin kokoisiksi. (Bryson 2005: 261–262.)

In the quote above, Bryson discusses the reasons why much of the planet is inhabitable to humans. Instead of simply using figures to describe the depth or height, he uses well-known buildings to illustrate how deep one would have to go to feel the effects of the water pressure. In addition, he uses a Coke can to describe size to which the lungs would compress in those depths. Since imagining the size of a Coke can is easy, it is an apt metaphor for this type of text which does not use pictures. It is, in my opinion, very readable and flows better than the text in most textbooks. Päkkilä's translation is very similar to the ST, most likely because there is no need to change the original for the readers of the TT. The only major change is the omission of the Coke can; instead, it has been replaced by a more generic "virvoitusjuomatölkki [soda can]". This is possibly because only the size of the can is important, not the product it contains.

On a different note, Liao states that the readers of popularized science texts are not interested in reading about any theories or methods; their interest lies in the simple question "Is this of any use to me?" (Liao 2013: 130). In other words, Liao agrees with Kiikeri and Ylikoski's point of the whole general audience not being the target group of popularization. In this context it is important to note that popularization is not limited only to written texts. On a contrary, documentaries shown on television and the information available on internet and in museums also constitute as popularization (ibid.). The utilization of other medias besides books helps bringing popularized information available to a larger group of people than relying solely on literature would. However, I believe it is likely that the people who seek that information, regardless of what form it is presented, are those who are already interested in a particular subject.

Liao further argues that popularization is such a distinctive genre that the idea of translation – that specialized terms are moved into the popularized version – does not apply (Liao 2013: 131). According to her, concerns raised about the translation of popularized texts are in part similar to those raised about other science translations. For example the accuracy of scientific information is one such concern. (ibid.) However, Liao believes that the focus should not be only in accuracy but rather, in *accessibility* (ibid.). By accessibility, one means how easily and effectively the target readers can access the popularized information that is given to them. An example of what

constitutes as accessible information can be found in Bryson's book in a chapter discussing threats from outer space. In that chapter, Bryson tells about a crater beneath Manson, Iowa, that has disappeared from view because the passing ice sheets filled the crater in and smoothed the surface. He writes that

(2) ST: [t]he Mason impact was the biggest thing that has ever occurred on the mainland United States. Of any type. Ever. The crater it left behind was so colossal that if you stood on one edge you would only just be able to see the other side on a good day. It would make the Grand Canyon look quaint and trifling. (Bryson 2004: 238.)

TT: Mansonin törmäys oli kaikkien aikojen suurin pamaus Yhdysvaltojen manneralueella verrattiinpa sitä mihin tahansa. Törmäyskraatteri oli niin suuri, että kirkkaana päivänä sen reunalta saattoi hädin tuskin nähdä vastakkaista reunaa. Grand Canyon näyttäisi Mansonin kraatterin rinnalla pieneltä ja pittoreskilta. (Bryson 2005: 210.)

Here, Bryson has compared the Grand Canyon, a well-known landmark, to the Manson Crater which only a few people have heard of. The comparison certainly makes it easier to comprehend the size of the crater, and thus makes the text more accessible to the reader. This type of comparison is a common tool in popularization and it will be further discussed in subsection 4.2.2 of this thesis. It is reasonable to argue that the example 2 is well within the boundaries of popularization, partly because of the comparison mentioned above and partly because of the language used. It must be borne in mind, however, that defining what is or is not popularization is not always that easy. These problems in defining popularization will be discussed in section 3.1 below.

3.1 The dominant view and the continuity view

This section discusses two different views in the field of popularization. The first, the dominant view, is the older of the two views and has nowadays been replaced by the continuity view. This section outlines the differences between the two views and why the dominant view came to be replaced.

The questioning of boundaries of popularization arises, according to Greg Myers, from the fact that representatives of multitude of fields, including, but not being limited to, linguists, rhetoricians, science scholars and scientists themselves, have shown interest for popularized texts (Myers 2003: 265). Myers continues that the textual studies made by these researchers have usually fitted in the *dominant view*. According to this view, there are two sets of discourses; the first is to be used within scientific institutions, and the second is for the general public outside of the institutions. (ibid. 266) Myers further states that there are several assumptions that are taken for granted in the dominant view. According to one of them, it is scientists and researchers who define what science is; another assumption argues that the lay audience is a "blank slate of ignorance" on which "scientists write knowledge" and the knowledge can only be passed in one direction – that is, from the experts to the ignorant laymen. (ibid. 266.)

Conversely to the above assumption, Myers believes that the supposedly wide gulf between experts and laymen is not so wide after all (Myers 2003: 268). Firstly, he states, the division between "natural" sciences (e.g. physics and chemistry) and other knowledge did not happen until relatively recently (see also Blanning (2008) in section 1.3 of this thesis). As an example Myers mentions linguistics which only began to exclude "outsiders" (non-experts) in the 20th century. (ibid.) It is also worth keeping in mind that as soon as the expert deals with something outside of his or her area of expertise, he or she becomes less of an expert, or even a member of the lay audience (ibid.). For instance, even if a physicist specialized in nuclear technology is treated in the media as an expert for all fields of physics, they are, in fact, often reliant on others to fill in the information they lack. Sometimes that information has to be popularized in order for them to understand it. (ibid.)

Myers also points out that the information travelling between the experts and the public does not only flow in one direction nor is the public the blank slate the advocates of the dominant view would like to believe them to be (Myers 2003: 268). Granted, the public may not know what the difference between DNA and RNA is but they may know a lot about things that concern them directly. As an example, Myers mentions parents whose child has a rare disorder. He argues that it is possible that the parents know much about

that particular disorder, more than a general practitioner might know. (ibid.) It is also worth mentioning that people are in general more interested in issues concerning for instance their health than in an abstract science that is not likely to benefit them directly (ibid.). This attitude also partially explains the negative attitudes towards basic research because the innovations derived from it cannot be seen immediately. As Maija Karala notes in her article, it is easy to see basic research as useless and a waste of money even though it is the basic research that creates new fields and new innovations (Karala 2015: 23). In addition, Bensaude-Vincent argues that the "gap" between experts and public is a purely ideological creation, made by the popularizers themselves to place themselves as "mediators" (Bensaude-Vincent 2001: 100).

As was pointed out above, popularization is not only found in written texts, but also on other forms of media. Yet, as Myers writes, popularization research is focused mostly on written texts (Myers 2003: 272). He believes that this is partly due to two facts: the first is that discourse analysts are best equipped to deal with words and the second is that it is easy to collect and store written texts (e.g. newspaper articles). However, Myers believes, quite rightfully in my opinion, that excluding other forms of discourse than written texts limits popularization research. (ibid.) Firstly, visual encounters with science, such as television documentaries, are often more memorable than reading an article about the same subject. Secondly, new technology ensures that more pictures and other visual aids can be used even in traditional textbooks; after all, they say that a picture is worth a thousand words. Thirdly, merely focusing on words excludes places like science museums from popularization studies. Finally, Myers argues that focusing on words enhances the view that popularization is all about simplifying and even distorting the message. (ibid.)[9]

Moreover, Myers argues that popularization is also about the interaction between the scientists and the public (Myers 2003: 273). The dominant view presumes that if the public knows more about science, it would automatically be more receptive to the new ideas and innovations presented by scientists such as getting a new vaccine. What the

[9] Due to the material I have chosen and the scope of the thesis, I have left out television, the Internet and other possible venues for popularization. However, they are a possible subject for a future research.

dominant view fails to take into account, however, is that the audience forms its opinions based on the trustworthiness of the speaker and the institution he or she represents. Besides, the estimation of trustworthiness is in turn based on the "track record" of the speaker and the institution. (ibid.) To provide an example of the importance of a good reputation, let us suppose that the company that created the Pandemrix influenza vaccine wants to market a new vaccine. Even if the vaccine was described as perfectly safe, it would not be surprising if the public rejected the new vaccine based on the public's experiences with the company's previous product.

Gradually, the dominant view came to be reframed and replaced. An important part of this process was an article written by Thomas F. Gieryn, professor of sociology. In the article he created the concept of "boundary-work", or scientists' attempts to create a boundary between scientific and non-scientific works (Gieryn 1983: 782). Gieryn's concern was about how scientists tried to separate science from what they perceived to be non-science. Basically, boundary-work in this context concerns the ideologies surrounding scientists' "attempts to create a public image for science by contrasting it favorably to non-scientific intellectual or technical activities". (Gieryn 1983: 781.)

As a result of the reframing, a new view called the *continuity view* came to replace the dominant view. The most important difference is that the continuity view emphasizes that there is no gap between the experts and the laymen, only different levels of knowledge and interest (Downs 2010: 447). The new view also stresses that it is also important to understand the *context* of the communication. Does the communication take place between two experts discussing about a current research? Or is it a paper discussing current research? Or is it perhaps a newspaper article reporting of the research? Downs agrees with Myers that communication is never transferred only from the experts to the public. Instead, the public also communicates with the experts in the form of feedback and questions. (ibid.)

3.2 Popularization as a social process

In this thesis I will be following Calsamiglia and van Dijk's ideas on popularization. According to them, popularization is a *social process*. As has been stated already, it includes not only written texts, but also other forms of media, such as television. The aim of popularization is to "communicate lay versions of scientific knowledge, as well as opinions and ideologies of scholars, among the public at large". (Calsamiglia & van Dijk 2004: 371.) They therefore indirectly disagree with the scientists of the twentieth century who viewed opinion as being inferior to scientific knowledge and confined solely to the "ignorant masses".

Calsamiglia and van Dijk continue that there is no specific structure for the popularized text. Instead, it is the *roles* of the participants (e.g. scientific sources, specialized journalists, a lay public), the *purposes*, *beliefs*, and *knowledge* of the participants and the *relevance* of the information to the general public which characterize popularization. (Calsamiglia & van Dijk 2004: 371.) In other words, *recontextualization* is an essential part of popularization. Basically, this means that the content is adapted to suit the chosen media and, by extension, the intended audience. (ibid.)

Calsamiglia and van Dijk also note that the mass media is not simply passively repeating the scientific information passed to it; it actively takes part in distributing the knowledge. In particular the strength of the mass media arises from its power to decide which science news to publish and how to report about them. (Calsamiglia & van Dijk 2004: 371.) A quick look in the science page of the Huffington Post[10] reveals that the news concern either current issues (e.g. "The West Africa Ebola Epidemic Arouses Global Response But Caution Needs an Ally and a Local Interpreter"), human behavior or biology (e.g. "Why do we sleep?") or are about subjects that many people may find interesting (e.g. "FOUND: Traces of Ancient Monster Star", "Now We Know How Lizards Regrow Their Tails").

[10] This quick search was conducted in 23.8.2014

In my personal experience of having been an avid reader of the above mentioned news site for quite some time, articles in the biology category often include articles about space and prehistoric creatures, particularly dinosaurs and early humans. Many of the news are blog posts written by experts. For instance, the author of the Ebola article mentioned above, Sharon Hrynkow, PhD, is a virologist and the President of Global Virus Network which consists of virologists aiming to stop the spread of viral diseases in the world (Huffington Post 2014). Most likely, experience has shown that news items such as these are most likely to garner the most reads and thus it is in the interests of the online newspaper to keep publishing similar articles.

4 *SHORT HISTORY* AND *LYHYT HISTORIA* IN THE LIGHT OF USABILITY AND POPULARIZATION

In this chapter, I will analyze popularization and usability aspects of both *Short History* and *Lyhyt historia*. Given the nature of the theories I have chosen, I have decided to analyze the two aspects separately; the usability aspects of the material will be discussed in section 4.1, while in section 4.2 and its subsections, I delve into the popularization aspects. In section 4.3, usability and popularization will be analyzed together as I believe popularization and usability have overlapping qualities, such as the need to take the reader into account. In section 4.1, I find it necessary to make a synthesis between the two approaches because they are so closely linked. As in chapter 3, examples are included in this chapter from both the original source text and the translated target text, and they are marked with ST and TT, respectively.

4.1 Usability in *Short History* and *Lyhyt historia*

In this section, I will examine the usability in *Short History* and *Lyhyt historia*. However, before moving on to the analysis of usability, it is worth taking a look at the types of readers this book is aimed at. As has already been stated, Bryson describes himself as someone who did not know much about the Earth; he could not even tell "what a proton was, or a protein, didn't know a quark from a quasar" (Bryson 2004: 23). As such, it could be said that the book is aimed at someone like Bryson himself; someone who would like to know more about the planet we live one but who for some reason or other has not had time to apply oneself to the subject.

The book could also be aimed at those who have not read much scientific literature because they find the content uninspiring or even dull. This was certainly the case for Bryson who was disappointed to discover that the school textbooks he used were not as interesting as he thought they would be. In the introduction, he admits that he wrote the book partially because he wanted to see if it was possible to write about science in an interesting manner (Bryson 2004: 24).

As a book about the history of science, *Short History* is bound to contain terms which may be unfamiliar or difficult for the reader. Therefore, having an explanation for the terms would be preferable. Yet how important is the explanation of terms? According to Calsamiglia and van Dijk, the popularization process includes *reformulation* and *recontextualisation* of scientific knowledge; in other words, the information must be adapted for the context in which the information is published and, by extension, for the readers accessing that venue (Calsamiglia & van Dijk 2004: 371). When applying this to the *Short History*, it is, of course, notable that the book is aimed at the general audience. On a more specific level, the book is aimed at anyone who has, like Bryson, wondered how it is possible to know so much about Earth, and how, precisely, is that information obtained (Bryson 2004: 23). It is probably also safe to say that the reader of this book will be a layperson, an adult or a teenager; young children are unlikely to find this book entertaining because it contains very few pictures and requires a degree of concentration as well as reading skills. This being the case, it is safe to assume that the general reader of *Short History* is not well-versed in scientific terminology and thus providing an explanation for them is important. The following quote is a good example of scientific information adapted for a layman reader:

(3) ST: A few astronomers continue to think there may yet be a Planet X out there – a real whopper, perhaps as much as ten times the size of Jupiter, but so far out as to be invisible to us. (It would receive so little sunlight that it would have almost none to reflect.) (Bryson 2004: 42.)

TT: Edelleenkin on tähtitieteilijöitä, jotka uskovat planeetta X:n olemassaoloon – todelliseen jättiläiseen, kenties jopa kymmenen kertaa Jupiteria isompaan planeettaan, joka on toistaiseksi pysytellyt näkymättömissä. (Se saisi niin vähän auringonvaloa, ettei se heijastaisi sitä juuri lainkaan.) (Bryson 2005: 34.)

I believe it is safe to say that the vast majority of the readers of *Short History* know that Jupiter is the largest planet in our solar system. I also find it likely that they have at least once seen an artist's rendering of the solar system with the planets set in a straight line so that the viewer can compare the sizes of the planets[11]. With this in mind, it is quite

[11] See, for instance, the video at http://io9.com/5767504/amazing-video-shows-the-relative-sizes-of-all-the-planets-and-stars.

natural to wonder how a planet ten times the size of Jupiter would be able to elude the astronomers for so long. This is why the explanation Bryson has provided in the parentheses is so important; it explains how the giant planet has managed to stay invisible in terms that are easy for a non-expert to understand. In the TT, Päkkilä has also placed the explanation in parentheses. While both the ST and TT could have been worded without those parentheses and the quote would not have lost any important information, I argue that the explanation stands out better to a casual reader because it is a separate sentence inside parentheses.

While further discussing popularization, Calsamiglia and van Dijk emphasize that popularization by and large is characterized by the *communicative context* and the *roles* of those participating in the process: the scientific sources, the person converting the information to a popularized form (e.g. journalists specialized in science news), and the readers (the non-specialist public). In addition to the context and the roles, the *purpose*, *beliefs* and *knowledge* of the actors involved and the *relevance* of the information in the everyday life of the reader also affect the nature of the popularization. (Calsamiglia & van Dijk 2004: 371.) In the case of *Short History*, the communicative context is the wish to increase the knowledge about the history of science and what this planet of ours is like and how it came to be. The actors include Bill Bryson, his readers and the scientists he has interviewed in person and the books and articles he has read. Bryson's purpose is to both share what he has learned with his readers and increase their knowledge, as stated above. These purposes can also be attributed to the scientists as they most likely would like to teach the reader something new and make the branch of science they represent more familiar to the public. The purpose of the reader is more difficult to gauge since there are as many purposes as there are readers. For instance, for me personally the purpose of reading this book was to learn more about the planet's history and the ways that history has been uncovered. To someone else, however, the purpose might be simply to read in order to pass the time.

Furthermore, according to Calsamiglia and van Dijk, relevance in everyday life is one of the characteristics of popularization, yet it is difficult to imagine how the book could be relevant to the reader in their day-to-day life. It should be noted, however, that *Short*

History is not intended for that purpose. Instead, it is intended as an educative book, to be read by those who are interested in learning more or revising their knowledge. As such, it would seem that the book does not meet all of the conditions laid for popularization. However, it should be kept in mind that not all literature can be regarded as something that will help the reader in their everyday life. It could even be argued that only a small percentage of all literature, including books such as manuals and cook books, fills that particular requirement.

What is more, Calsamiglia and van Dijk argue that popularized works, particularly those appearing in the mass media, are involved in creating new knowledge and opinions especially about the scientists and even about science itself. Therefore, they do not simply passively distribute scientific knowledge. In addition, not all of this information is derived from scientific sources. (Calsamiglia & van Dijk 2004: 371.) It should also be noted that even though journalists and others working in media business rely on others to provide them the sources, they have some say in what is published and how it is published (ibid.). *Short History* fits neatly into this category. Bryson has not only included in the book the "big names" of scientific world, such as Einstein or Newton, but there are also some lesser known personalities and even scientists who have made a major contribution to our knowledge of the world around us yet whose names still remain unknown to the general public. One such person could be Clyde Tombaugh:

(4) ST: It [the newly discovered planet] was named Pluto, at least partially because the first two letters made a monogram from [Percival] Lowell's initials. Lowell was posthumously hailed everywhere as a genius of the first order and Tombaugh was largely forgotten, except among planetary astronomers, who tend to revere him. (Bryson 2004: 42.)

TT: Se nimettiin Plutoksi ainakin osittain siksi, että ensimmäiset kaksi kirjainta olivat Lowellin nimikirjaimet. Lowell sai suitsutusta suurena nerona, kun taas Tombaugh unohdettiin, paitsi planeettatutkijoiden keskuudessa, jossa hän nauttii melkoista arvostusta. (Bryson 2005: 34.)

Lowell's name could be familiar to at least some of the readers, and there is an observatory named after him in Flagstaff, Arizona. Tombaugh's name, on the other

hand, is unknown to the general public even though it was he who actually discovered Pluto. Lowell did hypothesize that there was a planet behind Neptune, but he died in 1916 before he could prove his claim. Based on Lowell's hypothesis, Tombaugh managed to find the elusive ninth planet.

Bryson's sources include many popular books, a point that has been regarded with slight disapproval (see more on this in section 4.2 of this thesis). This could be partially because Bryson has a ready access to these kinds of books or because he himself finds them easier to understand than science publications (after all, he is no expert). However, it is highly likely that popular books were chosen as a part of the source material because they are accessible to the reader of *Short History*. After all, science publications (e.g. theses, doctoral dissertations, articles etc.) may not be readily available to the general public or they may be difficult to understand without specialized training.

So far, I have discussed the aspects of popularization, yet the title of this chapter is "Usability". There is a good reason for my choice. First of all, I feel that the functions of usability and popularization are close to each other and the concepts, therefore, somewhat related (for more about this subject, see section 4.3 of this thesis). Secondly, many of the traits listed above apply to usability as well. As it was already noted in section 2.2 of this thesis, usability is concerned with how usable a product is – in other words, whether the product in question is both easy to use and beneficial to the user. In the same chapter, I argued that both the source text and the target text meet the required criteria even though they are not used in the same way that, say, manuals are, and moreover, that they are used more for enjoyment. However, it can be said that readers use *Short History* and *Lyhyt historia* if their goal is to learn more about the world, the history of science or famous scientists.

I also stated that, as per Bell's model, the speaker (in this case, the writer) will adjust his or her message according to who their recipient is. Bryson's recipients are, in the broad sense, the lay audience. In a narrower sense, however, it could be claimed that the audience consists of people like Bryson himself; someone who has wondered how the world is the way it is and how we can know so much about it. The primary recipient

(the second person or the *addressee*) was most likely frustrated with the school text books which did not answer the questions the reader may have had in a concise and understandable way. Perhaps, like Bryson, the addressee waits until adulthood before beginning to ask those questions again. Or, the addressee could be completely ignorant of scientific matters or his or her information could be outdated. It could even be that the addressee has simply forgotten something over the years and reading about it jogs their memory.

What about the third persons? Bell defines them as *auditors* and while they are known to the speaker, they are not directly addressed like the second person is; however, they do exert some degree of influence over the speaker. In the case of Bill Bryson and his book, the auditors would be readers to whom the subject matter is already familiar. Because of their previous knowledge, there is no need for Bryson to address them as much as he does the addressees, but he cannot completely ignore them, either, or else they would not finish reading his book. As such, Bryson needs to focus on other means to keep the auditors interested. His humor and style of writing could be those other means. While humor and style are certainly used to maintain the interest of the addressees, it could be argued that they are for the benefit of the auditors as well. Moreover, Bryson is not in the habit of overtly stressing the basic concepts of science. For instance, when Bryson discusses the structure of an atom, he merely mentions the following:

(5) ST: Every atom is made from three kinds of elementary particles: protons, which have a positive electrical charge; electrons, which have a negative electrical charge; and neutrons, which have no charge. Protons and neutrons are packed into the nucleus, while electrons spin around outside. The number of protons is what gives an atom its chemical identity. (Bryson 2004: 183.)

TT: Jokainen atomi koostuu kolmenlaisista rakennehiukkasista: protoneista joilla on positiivinen sähkövaraus, elektroneista joilla on negatiivinen sähkövaraus ja neutroneista joilla ei ole sähkövarausta. Protonit ja neutronit muodostavat atomin tiiviin ytimen, jota elektronit kiertävät. Atomin kemialliset ominaisuudet määräytyvät protonien lukumäärän mukaan. (Bryson 2005: 159.)

As can be seen from example 5, the explanations of the basic concepts that Bryson provides tend to be short and often serve to build for a discussion of more difficult concepts. The basic explanation of the structure of atoms is a good example of this kind of a difficult concept. Later in the book, Bryson builds on this explanation and uses it to illustrate why the early twentieth century physicists were so baffled by atoms.

It could be argued that to ensure the success of the book, it is more important to satisfy the needs of the auditors (the third persons) than those of the addressees (the second persons). I imagine that the auditors would form a larger readership than the addressees, and therefore it is important that there is something for the auditors as well besides learning about natural history. It could even be argued that there is some overlap between the second and third persons, and at times they can in fact switch places depending on the subject at hand. By this I mean that while the basic concepts and explanations are directed more towards the addressees, it is highly likely that the biographies of the researchers and scientists, as well as the more humorous tidbits, are catered towards the auditors. An example of a humorous biography is the one concerning a French expedition to Peru in 1735. The purpose of their expedition was to triangulate the circumference of the planet, but the expedition did not go as planned:

(6) ST: Almost at once things began to go wrong, sometimes spectacularly so. In Quito, the visitors somehow provoked the locals and were chased out of town by a mob armed with stones. Soon after, the expedition's doctor was murdered in a misunderstanding over a woman. The botanist became deranged. Others died of fevers and falls. The third most senior member of the party, a man named Jean Godin, ran off with a thirteen-year-old girl and could not be induced to return. (Bryson 2004: 67–68.)

TT: Retki alkoi mennä pieleen heti kättelyssä ja kaiken lisäksi varsin pahasti. Quitossa retkikunnan jäsenet onnistuivat suututtamaan paikalliset asukkaat niin, että kiviä heittelevä väkijoukko karkotti heidät kaupungista. Vähän sen jälkeen retkikunnan lääkäri murhattiin erästä naista koskeneen väärinkäsityksen takia. Ryhmän kasvitieteilijä tuli hulluksi. Lisää matkalaisia kuoli kuumeeseen ja putoamisonnettomuuksiin. Retkikunnan kolmanneksi vanhin jäsen Jean Godin karkasi 13-vuotiaan tytön kanssa eikä suostunut enää liittymään tovereihinsa toistuvista suostutteluyrityksistä huolimatta. (Bryson 2005: 58.)

Example 6 is at the beginning of chapter 4 of the *Short History* and thus serves as a humorous introduction to the subject of the chapter at hand: the size of the Earth. While the unlucky French expedition is mentioned only a couple of times in the chapter, the passage quoted above is a suitable "lure" for the auditors precisely because of the humor.

The remaining two of Bell's categories, the *overhearers* and the *eavesdroppers*, are more difficult to place precisely because they are not formally acknowledged by the author. The overhearers, in particular, are difficult to place since their presence is known, but not validated. In other words, the existence of such readership is known, but the author does not take their presence into consideration when writing the book. It could, perhaps, be argued that the overhearers are the future readers of the translated versions. Given Bryson's earlier success as an author, he must have been aware of the fact that his book might be translated into different languages. However, there is no indication he would have considered the possible translators when writing the book for there are plenty of examples of phrases and sentences which are difficult to translate into a foreign language without losing some of the intended meaning. Very often these passages also include humor which is notoriously difficult to translate (more on the subject, please refer to chapter 4.2.2 of this thesis).

Unlike the three previous categories, eavesdroppers are not acknowledged and the author is therefore unaware of them. As with the overhearers, it is difficult to place a group of readers into this category. Perhaps the eavesdroppers could be young readers, as I have already argued in this chapter that the book is catered towards adult readership. While the language is not particularly difficult, there is very little that would appeal to a young reader (whom I would place under the age of fifteen or so). This is because most of the jokes are made with adult readership in mind and require some knowledge about scientific matters to fully appreciate the joke. Moreover, there are no pictures in the book, which means that the reader is forced to imagine everything in their mind, something that might be off-putting for the younger readers.

We have now examined who the addressees, auditors, overhearers and eavesdroppers of *Short History* might be and will now turn to the usability aspect of the book. Let us start

with the contents of Bryson's book. Whenever I try to decide if a book is useful to me, I read through the table of contents in order to obtain an overview of the book and its structure. Since the index is comprised of the titles of the chapters and subchapters, the headings and subheadings should be both informative and eye-catching. A good example of this is the chapter titled *Bang!* It is the first subchapter of section IV, *Dangerous Planet* and is followed by a subchapter named *The Fire Below*. This gives the reader a good idea of what the chapter is about: it most likely involves something that explodes and it makes our planet a dangerous place. Therefore, it comes as no surprise that the chapter in question discusses meteor impacts. In addition, the title consists of only a word and an exclamation mark, which is catchier and draws the reader's attention better than a title like "Meteor impacts" would. Similarly, the reader can safely deduce that the following chapter, *The Fire Below*, will discuss at least in part volcanoes. To be more exact, that chapter is about the interior of the planet and discusses all phenomena involving the changes in its interior; volcanoes are indeed included, as are earthquakes. Given that the chapters are titled in a way that the reader can confidently guess what the contents of a specific chapter are, and the titles are eye-catching and interesting, it can be claimed that the table of contents is usable to the reader.[12]

Another means to measure the usability of the book is to take a look at the index. I generally leaf through it when I want to know if a book discusses a particular subject that is not mentioned in the table of contents. A good index, in my experience, is clear and easy to read, and includes the most important key words. Occasionally, I have come across a book which does not mention a certain subject in the index, yet I later discover it in the text. The reason for the omission might be that it is a minor subject; therefore, during the compilation of the index, it was possibly decided that it was unnecessary to include the subject in question. After all, if every single key word was included, the index would become unreasonably long and that could have repercussions on the readability of the index. I, for one, would not want to search through a list of hundreds of different keywords. Indexes are alphabetical, true enough, but if every keyword is

[12] As I stated in the section 1.2 of this thesis, the analysis is solely based on my interpretation of the material. Thus, I have a double role as both a reader and an analyst.

included, there could be several synonyms for a keyword and, at worst, the reader will have to go through all of them to find the information he or she seeks. For that reason, it is better to exclude the keywords which may occur only once or twice. Of course, the length of the book is also a decisive factor. In a shorter book, more keywords can be included in the index for in all likelihood the number of keywords is lower in a book with a low page-count.

By now I have discussed the importance of both the table of contents and index for readability. From here, we move on to the overall layout of the book. We already touched the subject briefly above when I discussed how Bryson's chapters are grouped together in a way that the reader will have no trouble in guessing what the subject of these chapters will be. I also mentioned in the first chapter that the chapters are grouped in six sections and these sections proceed in a seemingly chronological order. The first three chapters discuss the birth of the universe and other space-related matters. After that, Bryson moves to the seventeenth and eighteenth centuries and earth-related matters; more specifically, the next few chapters discuss geology, paleontology and how to measure the size and age of the planet. The answer to the last question is not discovered in these chapters, however; instead, Bryson returns to it in a later chapter. In other instances as well he introduces a theme or a person but leaves the story halfway through and returns to it later. This may sound like choppy storytelling, but Bryson always reminds the reader, usually in a humorous way, that this subject or person was mentioned before. An example of such a strategy is a certain eighteenth-century reverend who used to do his field work in his clerical gowns; he is later re-introduced as "he of the flowing gowns" (Bryson 2004: 97) (more about this eccentric geologist-reverend, please see chapter 4.2.2 of this thesis).

I personally like Bryson's way of writing. Not explaining everything in a single chapter works very well for me, thereby the reader is not overwhelmed with information. Moreover, continuing this or that theme in another chapter is an effective way to keep the reader interested. It is important to note, however, that Bryson does not simply drop a subject without an explanation and continue it in another chapter; instead, he states that "We shall turn to these ourselves in a moment, but first we must make a slight

detour" (Bryson 2004: 155) or something similar to alert the reader that the subject is dropped for the moment but he will return to it later. As was already pointed out above, he also reminds the reader that this subject has already been discussed earlier in the book which gives the reader an opportunity to go back to refresh their memory. From here I get to the importance of a working index. The reader may not remember exactly where the subject was last discussed, but if the index is well-written, it is easy for the reader to find the part they are looking for with the help of the key words.

In his translation, Päkkilä follows the structure of the source text, performing some minor changes to better accommodate the needs of the readers of the target text (changing the word order, omitting or adding something etc.). In the index, Päkkilä has occasionally added an explanation after the key word[13]. Päkkilä has, for example, added that CERN is also known in Finnish as *Euroopan hiukkasfysiikan tutkimuslaitos* (European Organization for Nuclear Research in English). The initials CERN are frequently used in Finnish but it is possible that they are not familiar to every reader; thus the Finnish name is important for their understanding. However, only CERN is listed in the index of the target text, which could be problematic. The reader might want to search for the Finnish term and not remember the name CERN and would therefore be confused. There has been precedence for using both the English and Finnish terms in the index; for instance, the key word *Royal Society* redirects the reader to another key word, *Englannin kuninkaallinen luonnontieteiden akatemia (Royal Society)*.

When I conducted the interview with Päkkilä he mentioned he could not recall whether he had a particular readership in mind when he did the translation. He says that if he was thinking of any particular group of readers, it would have been young readers. However, his intention was to write a popular translation for an ordinary reader because from his point of view, the intended reader was so ingrained in the source text it would have been wrong to stray from it. (Päkkilä 2015.)

[13] Bryson occasionally does this as well. For instance, he has added that the initials CFC are short for chlorofluorocarbons.

Interestingly, Päkkilä also mentioned he discovered that high school textbooks were very useful as source material because the information they present is roughly on the same level as in the *Short History*. As for the process of translating, Päkkilä told me he began translating from the chapters discussing oceans because he felt those were the easiest parts since his hobby is scuba diving. As for the rest of the book, much of the information he used was gathered from either books or from the Internet, but he also discussed some of the parts with experts from different fields. Moreover, the book was edited by Markus Hotakainen, who specializes in astronomy, and Päkkilä recalls that the text was partially read by yet another specialist in Werner Söderström. (Päkkilä 2015.)

Like Bryson, Päkkilä is no expert in natural sciences. He mentions that the *Short History* is the first book he has translated on the subject (although he has translated books about history before), but given that the book is popular literature, he feels that him not being an expert is an advantage. (Päkkilä 2015.) He does have a point; it can be said that this helps him to see better through the eyes of the reader. Moreover, while there are a few mistakes in the book, Päkkilä is of the opinion that the facts are not as important as Bryson's enthusiastic and compelling writing which he hopes has encouraged readers to find out more about the subject (Päkkilä 2015).

In other words, for the usability of the book, the complete accuracy of the text is not as important as the way in which the information is presented. If the text is fully accurate, but the presentation is flawed, the readers are not going to enjoy the book and it will not sell as well as a book with a couple of mistakes here and there but which is also readable and gripping. It must also be added that the possible mistakes can be corrected if new editions of the book are made, but it is considerably more difficult to change the style of writing. Also, if the readers of the book are not familiar with science, they are unlikely to spot the errors unless they are particularly glaring (e.g. the author uses meters instead of kilometers or vice versa). Naturally, this may result in some confusion for the reader if they come across conflicting information somewhere else. Even so, the likelihood of such mistakes preventing them from reading popular science literature or moving on to more scientific writings seems improbable. It could even be argued that

having an access to popular science literature is a definite advantage as it could prove to be the meeting point of the experts and the general populace.

4.2 Popularization in *Short History* and *Lyhyt historia*

This section discusses how popularization in general manifests in the material I have chosen for this thesis. In the following three subsections I discuss the different aspects of popularization more thoroughly. Two of these aspects, humor and explaining and omitting terminology, have been chosen for closer examination because in my opinion these two aspects are the most prominent in the material. They will be discussed in sections 4.2.2 and 4.2.3, respectively.

There has been much debate about what constitutes ‘good’ popularization or whether good popularization is possible in the first place. Gustaaf C. Cornelis believes that it is indeed possible to produce an ideal popularization, but only if certain conditions are met. He states that a popularizer should always aim at objectivity for a layman cannot always tell the difference between science and pseudo-science. In addition, excessive speculation should be avoided if possible, although Cornelis acknowledges that in some fields of science, such as cosmology, this is not possible since speculation is such an intricate part of the field itself. However, Cornelis emphasizes that if speculation cannot be entirely avoided, it should be clearly stated that the issue at stake is not known for certain. Finally, Cornelis notes that it is vitally important that popularization is not used for the author’s own gain. (Cornelis 1998.) Such gains could include promoting a controversial theory without substantial evidence or discrediting another researcher for personal reasons.

Everyone seems to agree that good popularization should be accurate (i.e. there is no false information), but there are those who believe that accurate popularization is not possible unless a scientist has written it. As was noted in chapter 1, some believe that popularization should be left to veteran scientists who are no longer actively doing research (Kiikeri & Ylikoski 2004: 191). Conversely, Jonathan Amos, BBC science correspondent, has expressed a view that having an arts background can be useful in

writing science news (Geology for Global Development 2013). He also believes that scientists do not always know how to express themselves in a way that is both believable and understandable to the general public and thus they require help from those who can write smoothly, much like James Hutton required John Playfair to edit his book to a coherent form (see subsection 4.2.3 for further details) (ibid.). Amos is of the opinion that having no science background can be helpful, because that way one knows how to ask the questions that the general populace wants answered (ibid.). Josephine Bacon, however, disagrees with this and laments that these days, science translators are too often Arts graduates (Bacon 2002).

Thus, there is a dilemma. On one hand, there are those who believe that having no background in science can be a good thing, because that way one can see what is relevant and interesting to the public. On the other hand, there are those who insist on science correspondents and other science writers having a background in science; how else could they understand what they are writing about? Bryson, however, openly admits that he knew nothing about the Earth and how it is studied (Bryson 2004: 23). Therefore, according to the proponents of the first way of thinking, he should not have written this book. Yet, in the acknowledgements Bryson mentions that Ian Tattersal of the American Museum of Natural History had corrected the chapters discussing early humans (ibid. 13). Based on this, it would seem that Bryson follows the second way of thinking; it is not about what you know, but the questions you ask. Bryson interviewed many professional scientists for the book, but he also interviewed some enthusiastic amateurs, such as the Revered Robert Evans from Australia who in his free time hunts supernovae (ibid. 51).

Let us focus for a moment on Bryson's supposed inability to write believable scientific literature. In his review, Hannu Karttunen points out that the section which covers Karttunen's area of specialty (astronomy) contains several mistakes. They may be small and even insignificant (for example, Bryson has incorrectly stated that the star Betelgeuse is 50,000 light years from us). Nevertheless, Karttunen argues that it is detrimental to a book to have too many of mistakes like that. He also argues that if the area he is familiar with is so ridden with mistakes, how many are there in the book as a

whole. (Karttunen 2006: 69.) Karttunen wonders if any of the interviewees ever checked the book for inaccuracies (ibid. 70). However, as was pointed out above, Bryson clearly notes in the acknowledgments that Ian Tattersall, the Curator Emeritus of the Division of Anthropology in the American Museum of Natural History (American Museum of Natural History 2014), and many others have reviewed the sections of the book which correspond with their own fields (Bryson 2004: 13).

Karttunen also questions Bryson's usage of popular science literature as his reference material because books like that often include second-hand knowledge which may be inaccurate. On the other hand, Karttunen does acknowledge that the popular science books that Bryson used are, for the most part, correct (Karttunen 2006: 69). Although at the end of the review Karttunen admits he finds the book "funny", he makes it quite clear that he hopes it encourages readers to familiarize themselves with "more credible" science literature in general (ibid. 70). In fact, he even claims that he does not think highly of the book or of popular science literature in general, even going so far as to claim that having popular science literature as the only source material often means that it is pseudo-science (ibid. 69).

Next, I will examine *Short History* from the point of view of Jonathan Amos's claim. As was stated in the Introduction chapter, Bryson is mostly known for his travel books. He is not, by any stretch of imagination, a scientist or a researcher nor does he pretend to be one. However, he is aware of what he does not know and where he might find the information he lacks. He also knows what questions he needs to ask to find the answers. Jonathan Amos, who has been the BBC science correspondent since 1994, says that it does not matter how much you know about a certain subject; it is far more important to ask the right questions (Geology for Global Development 2013). He also adds that even though scientists have the best qualifications to explain their research to others, sometimes they require help from communications experts to put their message into a coherent form that will also attract the attention of potential sponsors (ibid.). In Amos's opinion, being able to write about a locust's hind leg in one moment and about the higgs boson in the next is vital (ibid.); diversity, then, is one qualification demanded from a successful science writer.

When looked from this perspective, Bill Bryson seems to be the right person to write this book. Many of his books have been critically acclaimed and he has been praised for his penmanship. His books have won several awards. For example, in 2004 *Short History* won the Royal Society's Aventis Prize[14] (Royal Society Winton Prize for Science Books 2015), while in 2005, the book won the European Commission's Descartes Science Communication Prize (European Commission 2006). In 2003, another one of Bryson's books, *Notes from a Small Island*, was voted to be the book that best represents England in a World Book Day poll (BBC News 2003)[15]. Bryson is also well-known as an author and his books are almost guaranteed to sell; therefore, the scientists and researchers who agreed to an interview with Bryson get publicity to themselves and the branch they represent.

Despite believing that possessing a background in science is not mandatory, Amos mentions the ability to distinguish the relevant information from the irrelevant as one advantage to having a science background (Geology for Global Development 2013). In this aspect Bryson is definitely lacking, but he does have the publisher to help him decide what is included in the book and what is not. While the decision not to include certain branches of science (e.g. mathematics), the exclusion of a mention of the scientists' working methods and the focus on certain scientists quirks and oddities has elicited criticism from certain sources (Dupuis 2010), it ought to be remembered that the aim of this book is also to entertain the reader in addition to introducing them to the history of science and to the scientists who have helped to increase our knowledge on the planet we live on.

Based on what I have written earlier in this thesis (see section 1.3), it could be argued that a condescending attitude towards popular science is regrettably common. At the same time, however, it is recognized that there is a need for popular science. Indeed, in a survey commissioned by the Royal Society, it was discovered that researchers

[14] Nowadays the prize is called Royal Society Winton Prize for Science Books
[15] The voters also picked books which best represented Wales, Scotland and Northern Ireland (BBC News 2003)

themselves believe that the public has a right to know about the recent discoveries and how those discoveries can help them in their daily lives (Royal Society 2006: 9). In the Royal Society survey, it was also discovered that some researchers view those who engage with the public as less qualified for serious scientific activities. In addition, popular science is seen as detrimental to those women who take part in public engagement activities because of the view that it is seen as 'light' or fluffy'. (ibid. 11.)

While the importance of popularization is recognized (Royal Society 2006: 9), it is also thought best to be left to veteran scientists who are no longer actively partaking in research (Kiikeri & Ylikoski 2004: 191). It is thus seen to be a lesser form of science. However, many do not realize that school text books also count as popularization. In fact, Massimiano Bucchi situates pedagogic level only one step above popular level (Bucchi 2008: 61). Furthermore, Doctor Rudolf Stichweh is of the opinion that pedagogical popularization is probably the dominant form of popularization since it also includes the act of teaching students (Stickweh 2003: 4). Similarly, a discussion with a colleague who specializes in a different area – Bucchi calls this *interspecialist communication* (Bucchi 2008: 61) – also requires a researcher to change his or her "more technical presentation of one's research to a well-balanced version which accommodates the knowledge and the capabilities of understanding one ascribes to the respective colleague" (Stichweh 2003: 4).

4.2.1 Aspects of popularization

In this section I shall discuss the general aspects of popularization occurring in Bryson's book. I shall begin by highlighting the differences between popular science and academic discourse before moving on to the aspects of popularization. Two aspects, humor and omission and explanation of terms, are discussed in separate sections because of their relevance in the *Short History* and *Lyhyt historia*. Another relevant aspect, the comparison of something scientific with something commonplace, will be analyzed together with humor in subsection 4.2.2 since in Bryson's writing the two are often intertwined.

In the book, Bryson has focused on the actual findings of the scientists, but he has also received criticism for not paying sufficient amount of attention to scientists' actual working methods (see, for instance, Dupuis 2010). Dupuis also criticized Bryson for focusing too much on physics and geography at the expense of mathematics and computer sciences, among others (Dupuis 2010). I, however, can understand the decision to leave these subjects out. Since the book is clearly focused on natural history, the exclusion of computer sciences is understandable. As for mathematics, while the book does not explicitly address it, it is not fully excluded either, given how important part it plays in understanding, for instance, physics.

As has already been noted in chapter 4.1 of this thesis, the motivation for writing this particular book arose from Bryson's need to understand this world; he has written extensively about how the book came to be in the introduction to *Short History*. Yet it is not only his voice that is heard in the book; it has by now been established that Bryson is no scientist and thus he has interviewed many scientists and researchers from several different fields. By doing this, he is contributing to the practice of calling forth scientists to influence the public opinion for instance in newspapers (Calsamiglia and López Ferrero 2003: 148). The following quote illustrates this well:

(7) ST: 'Chicxulub [crater on the coast of Mexico] is buried under two or three kilometers of limestone and mostly offshore, which makes it difficult to study,' [Ray] Anderson went on, 'while Manson is really quite accessible. It's because it is buried that it is actually comparatively pristine.' (Bryson 2004: 253.)

TT: "Chicxulub on sitä paitsi pari kolme kilometriä paksun kalkkikivikerroksen alla ja pääosin meren pohjassa, joten se on hankala tutkimuskohde", Anderson jatkoi. "Mansonin kraatteria sen sijaan on helppo tutkia. Ja koska se on hautautunut maakerrosten alle, se on säilynyt suhteellisen koskemattomana." (Bryson 2005: 223.)

Ray Anderson and his colleague Brian Witzke are geologists working for the Iowa Department of Natural Resources (Bryson 2004: 249). Bryson interviewed them personally about the time when the Manson crater (see example 2) was suspected to be left by the asteroid which caused the extinction of dinosaurs. While this was later

proven false, due to the reasons mentioned in the quote, Manson crater is much more accessible and easier to study than some of the other craters (ibid.: 253.) Since this was pointed out by a geologist who is personally familiar with the crater, it gives the information provided more credibility.

According to Bryson, another reason he wanted to write this book was that the school textbooks in his youth were, as he puts it, "not exciting at all". They were not even fully understandable. (Bryson 2004: 22.) He states that, to him, it seemed like there was some kind of a conspiracy hatched between the textbook authors to keep everything even remotely interesting as a secret only focusing on the boring diagrams and formulas instead. At that time, Bryson was not aware of the science writers (such as Timothy Ferris and Richard Feynman) who were able to write scientific facts in an interesting manner because "none of them wrote any textbook I ever used". Thus Bryson became convinced that science was boring and difficult, although he did have a hunch that it did not necessarily have to be so. (ibid. 22–23.)

Nowadays it is expected that scientists emerge from their laboratories and offices and communicate with the general public. As was seen in the survey of the Royal Society, approximately half of those surveyed wished to spend more time engaging with the public; at the same time, however, 73 % reported that they had no training communication, media or public engagement (Royal Society 2006: 12). In spite of this, having no training is not necessarily a problem as the scientists can work together with a trained communicator to help them to get their message across (Geology for Global Development 2013). Jonathan Amos stresses that, in the end, a scientist is the best person to tell the public about his or her own work (ibid.) and this is undoubtedly the case. The communicator has not spent countless hours working with whatever the current research project is, the scientist has, and therefore only the scientist knows the project thoroughly enough to be able to say something worthwhile about it. With that being said, the communicator can help the scientist identify the subjects the general public may find the most interesting and useful in their daily lives, and this is what Bryson has done in the *Short History*. Take, for instance, the following quote. While it is not exactly useful for the reader, I believe it is of interest to them since it is about

early humans and the supposed ancestor of *Homo sapiens*, an australopithecine called Lucy (more of Lucy and other early humans see section 4.3 of this thesis).

(8) ST: 'Lucy and her kind did not locomote in anything like modern human fashion,' insists [Ian] Tattersall. 'Only when these hominids had to travel between arboreal habitats would they find themselves walking bipedally, "forced" to do so by their own anatomies.' [Donald] Johanson doesn't accept this. 'Lucy's hips and the muscular arrangement of her pelvis', he has written, 'would have made it as hard for her to climb trees as it is for modern humans.' (Bryson 2004: 535–536.)

TT: "Lucy lajitovereineen ei liikkunut ollenkaan samalla tavalla kuin nykyihminen", Tattersall väittää. "Hominidit ryhtyivät kävelemään kahdella jalalla vasta, kun niiden oli pakko siirtyä puita kasvavasta elinpiiristä toiseen. Niiden anatomia pakotti ne liikkumaan kahdella jalalla." Johanson on eri mieltä. "Lucyn lantion luusto ja lihakset olivat sellaiset, että sen oli aivan yhtä vaikea kiivetä puuhun kuin modernin ihmisen", Johanson kirjoittaa.

By interviewing the scientists and quoting the books they have written, Bryson has given them a chance to communicate with the public and promote the knowledge of the branches of science each of them represent, even of the contradictory ideas. The reader can also find more information via the extensive bibliography at the end of the book. This bibliography consists not only works by those Bryson has interviewed and quoted in the book, but also books and articles he has read while he was writing the *Short History*, works by notable scientists such as Charles Darwin and popular science literature. While there has been criticism for his inclusion of popular literature (see Dupuis 2010 or section 4.2 of this thesis), it is important to remember that the majority of the readers of the book have no scientific training and therefore some popularized literature should be included in the bibliography for their convenience. In the example 8 above, Bryson has quoted Donald Johanson's article from National Geographic. He has also directly quoted other popular literature and often, these quotes serve to illustrate the more amusing traits of scientists. The quote below is a good example of this:

(9) ST: As John Reader understatedly observes in the book *Missing Links*, 'It is remarkable how often the first interpretations of new evidence have confirmed the preconceptions of its discoverer.' (Bryson 2004: 531.)

> TT: Kuten John Reader toteaa kuivasti kirjassaan *Missing Links*: ”On merkille pantavaa, kuinka usein uusien löytöjen ensitulkinnat ovat vahvistaneet löytäjänsä ennakkokäsitykset.” (Bryson 2005: 476.)

In addition to giving a voice to the scientists he has interviewed, Bryson also speaks directly to the reader. He, for instance, asks the reader to imagine a certain phenomenon in a specific manner. Take, for example, this quote concerning the explosion of Mount Tambora:

(10) ST: No-one living had seen such a fury. Tambora was far bigger than anything any living human has experienced. It was the biggest volcanic explosion in ten thousand years – 150 times the size of Mount St Helens, equivalent to sixty thousand Hiroshima-sized atom bombs. (Bryson 2004: 505.)

> TT: Kukaan nykyään elävä ihminen ei ole todistanut niin raivokasta luonnonnäytelmää, sillä Tamboran räjähdys oli suurin vulkaaninen purkaus kymmeneen tuhanteen vuoteen – 150 kertaa voimakkaampi kuin St Helensin purkaus eli se vastasi 60 000:ta Hiroshimassa räjähtänyttä pommia (Bryson 2005: 451).

Tambora exploded in 1815, and in order to demonstrate the size of the explosion, Bryson compares it to two well-known modern day catastrophes, the bombing of Hiroshima in 1945 and the eruption of Mount St Helens in 1980. By doing this, Bryson gives the reader something concrete to compare the explosion to, as both of these modern disasters are well documented.

Bryson does not hesitate to express his own views and speculations, either, as seen in the following quotes:

(11) ST: [James Hutton] was, as one biographer observed with an all but audible sigh, ‘almost entirely innocent of rhetorical accomplishments’. Nearly every line he penned was an invitation to slumber. Here he is in his 1795 masterwork, *A Theory of the Earth with Proofs and Illustrations*, discussing... well, something: [...] (Bryson 2004: 90)

> TT: Kuten eräs [James Huttonin] elämänkertansa kirjoittaja totesi melkein korvin kuultavan huokauksen säestämänä: ”häntä ei ollut siunattu kynämiehen lahjoilla”. Miltei jokainen hänen kirjoittamansa rivi

on kuin unilääkettä. Tässä hän käsittelee vuonna 1795 ilmestyneessä mestariteoksessaan *A Theory of the Earth with Proofs and Illustrations*... jotakin: [...] (Bryson 2005: 78)

(12) ST: Lyell, in his *Principles*, introduced additional units known as epochs or series to cover the period since the age of the dinosaurs, among them Pleistocene (‘most recent’), Pliocene (‘more recent’), Miocene (‘moderately recent) and the rather endearingly vague Oligocene (‘but a little recent’). (Bryson 2004: 101)

TT: *Principles*-kirjassaan Lyell ehdotti dinosaurusten ajan luokitteluun uusia aikayksiköitä, joita hän kutsui epookeiksi tai sarjoiksi. Näitä epookkeja olivat pleistoseeni (”tuorein”), plioseeni (”tuoreehko”), mioseeni (”suhteellisen tuore”) ja viehättävän hämärä oligoseeni (”ei kovin tuore”).

While he never explicitly says “I think that...” or “In my opinion...” in either example, the choice of words reveals that he is not merely stating a fact, he is also expressing his own views about the matter. Notable is also the fact that in example 8 Bryson uses a weak form of a verb (doesn’t) while in example 11 he uses a strong form (he is). However, this is most likely due to a stylistic decision rather than any popularization strategy.

4.2.2 Humor

This section discusses how humor manifests in the material. Humor is an essential part of all of Bill Bryson’s writing, and *Short History* is no exception. Bryson’s recognizable writing style is capturing, which is largely due to the humor, and, more importantly, Bryson’s ability to use humor effectively in his writing. As Bev Hogue points out, language has an important role in humor writing. She argues that the same ingredients that ensure the success of other types of writing – namely pace, timing, economy of expression and vivid language – make humor effective as well. (Hogue 2011: 201.) As to translating humor, Patrick Zabalbeascoa has labeled it untranslatable. However, Zabalbeascoa also argues that the common practice for translating humor seems to be to “translate the words and/or the contents and then keep your fingers crossed and hope that the humor will somehow come across with the rest”. (Zabalbeascoa 2005: 188.)

To help the translator to better translate humor, Zabalbeascoa has outlined different types of humor. Included in this outline are unrestricted jokes, which are relatively easy to translate since the readers of both the source text and the target text will understand the joke (Zabalbeascoa 2005: 189). Restricted jokes, Zabalbeascoa argues, are noticeably more difficult to translate because there is often some culture specific knowledge involved. In addition, the joke might be missed because there are no obvious indicators that a joke is about to follow, or the humor is presented by clever wordplays or puns. (ibid. 192–194.) These, he points out, are not necessarily difficult to translate, but they are easy to miss if the translator is too focused on the words only (ibid. 193).

Bryson's humor tends to often be subtle, which, in Zabalbeascoa's outline, is not difficult to translate, *per se*, but can be easily missed. For example, in chapter 8 Bryson writes:

> (13) ST: "If a thing could be oscillated, accelerated, perturbed, distilled, combined, weighed or made gaseous they [the nineteenth-century scientists] had done it, [...]" (Bryson 2004: 153)
>
> TT: Tiedemiehet olivat tutkineet kaikkea, mitä saattoi oskiloida, kiihdyttää, sekoittaa, tislata, yhdistää, punnita tai kaasuunnuttaa, [...] (Bryson 2005: 133)

Bryson could have simply written something along these lines: "If a thing could be measured or its form changed, the scientists had done it". However, it could be argued that my version would not have been as interesting to read as Bryson's. Because he chose to make a long list of verbs, the quote appears humorous and rhythmic, even though there is nothing overtly funny about it.

Another example of Bryson's subtle humor can be found in the chapter describing atoms. Atoms, he notes, are incredibly long-lived although no one is certain how long, exactly, they live. However, Britain's Astronomer Royal, Martin Rees, has estimated that each atom lives for approximately 10^{35} years. Bryson adds to this that it is such a large number even he who insists on writing everything with numbers is happy to use

the mathematical notation. (Bryson 2004: 176.) Now compare this with an example of Bryson's non-subtle humor. Upon describing how long-lived and durable atoms are, he mentions that each human carries a vast number of atoms which once belonged for instance to Shakespeare, Beethoven and Genghis Khan (ibid.). Bryson also notes that

(14) ST: The personages have to be historical, apparently, as it takes the atoms some decades to become thoroughly redistributed; however much you may wish it, you are not yet one with Elvis Presley (Bryson 2004: 176).

TT: Tämä tosin pätee vain historiallisiin henkilöihin, sillä ilmeisesti atomien kierrätys kestää muutamia vuosikymmeniä: vaikka kuinka toivoisimme, emme voi olla yhtä Elvis Presleyn kanssa (Bryson 2005: 153).

Calsamiglia and van Dijk point out that there is a social aspect to popularization which is not present in academic writing (Calsamiglia & van Dijk 2004: 370). We learn not only about *what* has been discovered, but also *who* has discovered it, *where* it has been discovered and *how* (if at all) it can be applied to everyday life (ibid.). In addition, the information should be presented in as coherent a way as possible (ibid.). Bryson has done his best to explain the difficult scientific phenomena in terms that the reader understands, such as comparing very small or very large numbers to something commonplace so that the reader could imagine the quantity better. However, the reason I have included this technique in this section instead of the previous one is that these comparisons often come across as humorous, as seen in the next example:

(15) ST: In a single blinding pulse, a moment of glory much too swift and expansive for any form of words, the singularity assumes heavenly dimensions, space beyond conception. The first lively second […] produces gravity and the other forces that govern physics. In less than a minute the universe is a million billion miles across and growing fast. […] In three minutes, 98 per cent of all the matter there is or will ever be has been produced. We have a universe. It is a place of the most wondrous and gratifying possibility, and beautiful, too. And it was all done in about the time it takes to make a sandwich. (Bryson 2004: 28.)

TT: Yhdessä sokaisevassa välähdyksessä, huikeana hetkenä joka on aivan liian lyhyt ja laajeneva jotta sitä voisi sanoin kuvata, singulariteetti saa taivaalliset ulottuvuudet ja muuttuu käsittämättömällä tavalla

> avaruudeksi. Tuon ensimmäisen tapahtumien täyttämän sekunnin aikana […] syntyvät niin painovoima kuin muutkin fysiikan voimat. Alle minuutissa maailmankaikkeus laajenee läpimitaltaan miljoonan miljardin kilometrin kokoiseksi ja jatkaa kasvuaan vauhdilla. […] Kolmessa minuutissa syntyy 98 prosenttia kaikessa olemassa olevasta aineesta. Tuloksena on maailmankaikkeus. Häkellyttävän ihmeellisten mahdollisuuksien tyyssija, joka on kaiken lisäksi vielä kauniskin. Ja koko komeus syntyi suunnilleen samassa ajassa, joka menee voileivän tekoon. (Bryson 2005: 22.)

As seen in the fifteenth example, the amount of time it took for the universe to form was astonishingly short. Precisely how short the amount of time was could be difficult for the reader to comprehend without the comparison of making a sandwich at the end of the quote. In addition, because sandwich-making is such an everyday task, it seems humorous compared to the creation of the universe.

History books are full of names and dates which may be difficult for a reader to remember. Seemingly being aware of this, Bryson has tried to use humor make the names at least slightly easier to remember. A good example of this is when he tells about the Revered William Buckland, a nineteenth-century English geologist. When first introduced, Bryson mentions that Buckland used to do his field work in his clerical gowns while other geologists of that era wore dark suits and top hats (Bryson 2004: 95). When we a little later learn more about him, the reader is reminded of Buckland's eccentric wardrobe in the following manner:

(16) ST: From his father [Charles] Lyell gained an interest in natural history, but it was in Oxford, where he fell under the spell of the Revered William Buckland – he of the flowing gowns – that the young Lyell began his lifelong devotion to geology.

Buckland was a bit of a charming oddity. […] (Bryson 2004: 97.)

TT: Isänsä esimerkkiä seuraten [Charles] Lyell kiinnostui luonnonhistoriasta, mutta elinikäinen omistautuminen geologialle virisi vasta Oxfordissa, jossa hän joutui liehuvassa opettajankaavussaan kenttätutkimuksia tehneen pastori Bucklandin pauloihin.

Buckland oli suorastaan hurmaava kummajainen. […] (Bryson 2005: 84.)

By reminding the reader that this was “he of the flowing gowns”, Bryson makes it easier to connect the name with what was said about him earlier. This is because the reader is likely to remember an eccentric fellow doing field work in flowing robes instead of wearing something a little more practical. Moreover, the mention of the gowns brings humor in the quote. It could be argued that it is precisely because of Buckland’s humorous attire that makes him more memorable.

In science, it is not unheard of for someone to be recognized for something someone else discovered or invented. Occasionally, the recognition comes from something they had not even tried to discover, and these make highly amusing reading even though it most certainly was not so for those whose work was not recognized. Bryson’s work has several examples of incidents like that, and one of them concerns the discovery of radiation left over by the Big Bang. Astrophysicist George Gamow had theorized in the 1940s that if one were to look deep enough into the space, they might be able to find traces of the radiation caused by the Big Bang. In 1965, a team of scientists located in the Princeton University and lead by Robert Dicke had been trying to prove Gamow’s theory. Unfortunately, neither Dicke nor his team had read Gamow’s article in which he suggested that a large communication antenna at Bell Laboratories in New Jersey might be suitable for finding the cosmic radiation (Gamow had calculated would have turned into microwaves by the time it reaches Earth). (Bryson 2004: 29–30.)

Similarly unfamiliar with Gamow’s article were Arno Penzias and Robert Wilson, both radio astronomers. At the same time as Dicke and his team were trying to discover cosmic radiation, Penzias and Wilson were doing experiments with the Bell antenna, but their work was constantly interrupted by a steady hissing noise. Penzias and Wilson struggled with the hiss for a year and did everything they could think of to get rid of it, including checking every system and plug, using duck tape to cover every steam on the disc and cleaning the disc from bird feces (which, Bryson points out, they called “white dielectric material” in a paper they later published). (Bryson 2004: 29–30.) When their attempts to silence the noise failed, Penzias and Wilson called Dicke, hoping he might be able to help them. Dicke realized at once the two radio astronomers had stumbled upon the radiation he had been unable to discover. (Bryson 2004: 30.)

What makes this passage humorous is the accidental nature of Penzias and Wilson's discovery. They hadn't tried to find the cosmic radiation and had worked diligently to rid themselves of it, while not too far from them, a team of scientists is desperately trying to find the thing Penzias and Wilson did not want to discover. Bryson further states that both Penzias and Wilson and Dicke's team published papers in the *Astrophysical Journal* about the radiation; the radio astronomers described what it was like to experience the hiss and Dicke explained what the hiss was (Bryson 2004: 31). Bryson continues that

(17) ST: [a]lthough Penzias and Wilson had not been looking for cosmic background radiation, didn't know what it was when they found it, and hadn't described or interpreted its character in any paper, they received the 1978 Nobel Prize in Physics. The Princeton researchers got only sympathy. According to Dennis Overbye in *Lonely Hearts of the Cosmos*, neither Penzias nor Wilson altogether understood the significance of what they had found until they read about it in the *New York Times*. (Bryson 2004: 31.)

TT: Vuonna 1978 Penzias ja Wilson saivat fysiikan Nobelin, vaikka he eivät olleet etsineet kosmista taustasäteilyä, eivät tunnistaneet löytöään omin neuvoin eivätkä koskaan kuvanneet tai selvitelleet sen luonnetta yhdessäkään artikkelissa. Princetonin tutkimusryhmä sai pelkkää myötätuntoa. Kirjassaan *Kosmoksen yksinäiset* Dennis Overbye kertoo, että Penzias ja Wilson eivät edes tajunneet löytönsä merkitystä, ennen kuin lukivat aiheesta kertovan jutun *New York Timesista*.

Because of the nature of this fortuitous accident (also known as the serendipitous) and how the two radio astronomers were awarded for something they had not even attempted to describe, the passage appears as funny to the reader, particularly since they read about their own achievements in the *New York Times* instead of a science publication.

Other similarly serendipitous incidents – such as Constantin Fahlberg finding saccharin, Alexander Fleming discovering penicillin and Wilhelm Conrad Röntgen developing the x-ray, just to name a few (Pohjoispää 2015: 38–39) – may seem hilarious to the reader, as often the scientists were attempting to find something else entirely. However, true

accidents are rare in science because in order to recognize the value of the mistake, one must be knowledgeable of the subject beforehand. Moreover, in some branches of science, like chemistry, unexpected reactions are commonplace. Whether or not those reactions are identified and their possibilities are recognized as something worthwhile is another matter entirely. (ibid. 38, 42.)

Fleming and Röntgen are known to even those who are not interested in science. Yet plenty of other scientists and researchers are practically unknown to the general public despite the important discoveries they have made (see also section 4.1 of this thesis). Humor may help to make them more memorable. This seems to be the case with one J. Willard Gibbs who, according to Bryson, is "perhaps the most brilliant person most people have never heard of" (Bryson 2004: 154). Gibbs was undoubtedly an eccentric personality; he spent almost his whole life within three-block radius of his apartment and the Yale campus in Connecticut where he worked. His courses attracted one student in average and for the first ten years he worked at Yale, he never drew his salary. At the same time, however, he proved that thermodynamics did not apply to only large scale phenomena, such as steam engines; it applied also in chemical reactions happening at an atomic level. (ibid. 154–155.)

As was the case with the Revered Buckland and his billowing gowns (see example 15), mentioning Gibbs's eccentricities helps to make him more memorable. Yet it is not only the oddities of the researchers that make them unforgettable; having an odd research subject may also help them to stand out. This is the case of Albert Michaelson and Edward Morley who were studying

(18) ST: the luminiferous ether, a stable, invisible, weightless, frictionless and unfortunately wholly imaginary medium that was thought to permeate the universe (Bryson 2004: 155–156).

TT: valo välittävään eetteriin – vakaaseen, näkymättömään, painottomaan, kitkattomaan ja ikävä kyllä läpeensä kuvitteelliseen aineeseen, jota maailmankaikkeuden oletettiin olevan täynnä (Bryson 2005: 135).

Studying something that does not exist may seem funny to a modern reader, but in the 1880s, when Michaelson and Morley were experimenting with it, there was no doubt about the existence of the luminiferous ether. The idea of its existence was conceived by Descartes and since the days of Newton, it has been one of the cornerstones of science. Particularly in the nineteenth century, when light and electromagnetism came to be seen as waves, or, in other words, types of vibrations, luminiferous ether was vitally important to the scientists because it explained how light travelled in space. Vibrations, required something to occur in, "hence the need for, and lasting devotion to, an ether". (Bryson 2004: 156.)

Isaac Newton had proposed that the speed light varies depending on whether the observer is moving away from or towards the source of light. However, Michaelson and Morley discovered that the speed of light did not, in fact, vary at all; it remained the same regardless of where the observer stood. What Michaelson and Morley did then was to inadvertently prove the luminiferous ether did not exist. (Bryson 2004: 157.) Their experiment also had other implication. Earlier in the chapter, Bryson mentions that this was the era when it was believed that in physics, everything worth discovering had already been discovered and all that was left to do was to refine the existing theories (ibid. 154).

However, the evidence was seemingly pointing in the direction that science had not discovered everything, and this is what Bryson attempts to highlight by using humor as a medium. He does not merely mention that it was during this year and by that researcher that it was discovered that not everything had been "oscillated, accelerated, perturbed, distilled, combined, weighed or made gaseous", to use the words of Bryson (Bryson 2004: 153). Instead, he tells the reader about an experiment conducted by two 19th century scientists which did not yield the results they were expecting to see. From here, Bryson moves to Max Plack (who was, in fact, introduced earlier in the chapter before Bryson made a quick "but relevant!" (ibid. 155) detour to Michaelson and Morley) and Albert Einstein. It was Plack who, in the 1900, conceived "quantum physics", a theory which would, in the words of Bryson, "lay the foundation for the whole of modern physics" (ibid. 158).

As Zabalbeascoa notes, humor in a text may contain elements which are difficult for the target culture readers to comprehend because they are so specific to the source culture, and these are, for that reason, challenging to translate. One such instance can be found from a passage discussing the attempts of the nineteenth-century scientists to discover the origins of the huge boulders which were found in the unlikeliest places, such as the flanks of mountains. Nowadays, it is known that these boulders were carried by the retreating ice, but in the 1800s, the concept of ice age was only beginning to form. The part which is challenging to translate so that the humor is not lost concerns erratic, or the displaced boulders. Bryson notes that one French naturalist proposed that compressed air erupting from the caverns had shot huge boulders up in the flanks of the Jura Mountains. He continues:

(19) ST: The term for a displaced boulder is an erratic, but in the nineteenth century the expression seemed to apply more often to the theories than to the rocks. (Bryson 2004: 507.)

TT. Monet muutkin 1800-luvun teoriat siirtolohkareista olivat vähintään yhtä lailla lennokkaita (Bryson 2005: 452).

What makes example 19 so difficult to translate is the term *erratic*. The Finnish term for these rocks is *siirtolohkare*, which means that any attempts to make fun of the "erratic" theories are for naught. Markku Päkkilä's solution to the problem is to omit the mention of an erratic. Instead, he focuses on the theory that compressed air eruptions would have moved the boulders high up on the mountainside, "like corks out of a popgun", as Bryson puts it (Bryson 2004: 507), and draws the joke from this. If the Finnish translation would be translated back into English, it would read: "Many other nineteenth-century theories about erratics were equally lively (lit. flying, air-bound)".

By changing the passage slightly, Päkkilä maintains Bryson's humor without actually changing the content. It would be easy to focus too much on the erratic and not notice that the passage is not, in fact, about them at all. Instead, the passage is about the "erratic" theories the nineteenth-century naturalists presented and therefore, Päkkilä's change is valid. With his translation, the target language reader is able to fully

appreciate the joke about the 19th century theories Bryson makes without the passage being filled with English-language terms that mean nothing to the reader.

4.2.3 Explaining or omitting terminology

The aim of popularization is, as has been already pointed out, to make something more understandable to someone not familiar with the subject. This is often achieved by *reformulating* the scientific knowledge (Calsamiglia & van Dijk 2004: 371); in other words, the knowledge can be, for instance, simplified, or there can be an added explanation. In one aspect, however, Bryson seems to have decided to go with what he deems to be a simplification even though that is not necessarily what the readers might think. Bryson points out in a footnote that although scientists commonly use exponents to mark large numbers, he does not understand how anyone could think that '$5.5 \text{ X } 10^9$' is any clearer than '5.5 billion' in a book aimed at the general audience (Bryson 2004: 32). Karttunen criticizes Bryson's choice, stating that even if the American audience fails to understand this notation, the usage of billions and septillions does not, in fact, tell the reader anything other than that the number is very big. Karttunen also points out that the matter is further complicated by the fact that billion, quintillion and septillion do not refer to the same amount in Finnish as they do in American English. (Karttunen 2006.)

Karttunen's opinion notwithstanding, it is an undisputed fact that a book which aims to make science approachable to all, whatever their previous knowledge might be, must be as clear and concise as possible and this includes choosing a numbering method which is familiar to the majority of the readers. In addition to clarity, a book like *Short History* must also be consistent; if the author chooses to use billions and trillions instead of the small number in the right-hand upper corner of the other number, he or she must persist with that choice till the end of the book.

In the Finnish version, there is no mention of Päkkilä using any existing translation for the numerous quotes found in *Short History*. A quick look at the notes reveals that the names of the books are in their original form, most likely because they have not been

translated, as yet, into Finnish. This is both a blessing and a curse from the translator's point of view. Since there are no existing translations, Päkkilä is free to translate them as he wishes, without having to worry about copyrights. At the same time, however, having to translate the quotes from the older sources is difficult, because they may contain archaic terms for which there may not be a Finnish equivalent. If such a problem arises, the translator must decide whether to use a more modern term, which might confuse the reader, or to translate the archaic term him or herself, in which case the reader might not understand what the term means if the translation is not descriptive enough. However, Päkkilä has made a commendable job while translating this book. As was stated earlier in chapter one, he received the J. A. Hollo award in 2006 for his translation of the *Short History*.

The Finnish translation follows closely the form of the original. Naturally there is some deviation, mostly due to the different language structures and grammar. Päkkilä has also done his best to translate Bryson's jokes so that they appear as funny to the Finnish reader as well. Occasionally, this means that the joke, which often was an indirect one in the vein of the list of verbs quoted earlier, had to be omitted and replaced with another indirect joke. As an example of such a strategy there is this quote:

(20) ST: Luckily, Hutton had a Boswell in the form of John Playfair, a professor of mathematics at the University of Edinburgh and a close friend, who not only could write silken prose but – thanks to many years at Hutton's elbow – actually understood what Hutton was trying to say, most of the time. (Bryson 2004: 94)

TT: Onnekseen Hutton sai tunnollisen elämänkerran kirjoittajan John Playfairista, Edinburghin yliopiston matematiikan professorista ja hyvästä ystävästään, joka ei ainoastaan osannut kirjoittaa silkinsileää tekstiä, vaan seurattuaan ystävänsä työskentelyä vuosikaudet hän myös ymmärsi, mitä Hutton tarkoitti – ainakin suurimmaksi osaksi. (Bryson 2005: 81)

Notable is the omission of Boswell in the TT (although this could be because there is no mention of a Boswell earlier in the book – instead, there is a Maxwell who edited scientist Henry Cavendish's papers in the nineteenth century (Bryson 2004: 87)) as well

as the replacement of a comma with a dash at the end of the sentence. Päkkilä had also omitted the dashes Bryson had used earlier, most likely because they would not have worked as well in Finnish. However, the overall feeling as well as the idea of the original quote remains unchanged in the translation. This is, in part, due to Päkkilä replacing what he has omitted with items that have a similar "feeling" to the original. Thus, instead of getting "a Boswell", Hutton received a "tunnollinen elämänkerran kirjoittaja [diligent biography author]". Also, the separate idea, "[...] – thanks to many years at Hutton's elbow – [...]" has not been completely omitted. Instead, it has been replaced by a similar separate idea, "[...] – ainakin suurimmaksi osaksi [for the most part]".

As stated before, Bryson interviewed many scientists and other professionals for the book, and as such, the book is full of quotes. Since they came from Bryson's own interviews, naturally they have not been translated before and Päkkilä has had a free reign with them. He has chosen to keep the quotes direct (as opposed to changing them to indirect quotes), perhaps because they do not deviate from the style of the book and because, as I already said, they have not been translated before. Here is one example of how Päkkilä has translated a quote:

(21) ST: 'Well, you have to remember,' [Frank] Asaro recalls, 'that we were amateurs in this field [paleontology]. Walter [Alvarez] was a geologist specializing in paleomagnetism, Luis [Alvarez] was a physicist and I was a nuclear chemist. And now here we were telling paleontologists that we had solved a problem that had eluded them for over a century. It's not terribly surprising that they didn't embrace it immediately.' As Luis Alvarez joked: 'We were caught practicing geology without a licence.' (Bryson 2004: 247)

TT: "Pitää muistaa, että me kaikki olimme amatöörejä", Asaro sanoo. "Walter oli paleomagnetismiin erikoistunut geologi, Luis oli fyysikko ja minun alaani oli ydinkemia. Kun tällainen porukka ilmoittaa yhtäkkiä paleontologeille ratkaisseensa yli vuosisadan vastausta vailla olleen arvoituksen, ei ole mikään ihme, ettei teoriaa hyväksytty suoralta kädeltä." Luis Alvarez puolestaan vitsaili: "Meidät tuomittiin luvattomasta geologian harjoittamisesta." (Bryson 2005: 218)

The first thing the reader notices is that, unlike in the ST, Päkkilä has chosen to move the name of the person who makes the comment to the end of the quote instead of keeping it in the middle like Bryson. One possible explanation to this is that Päkkilä felt that keeping the sentence where Asaro notes he and the Alvarezs were only amateurs intact makes more sense to the Finnish reader than cutting the sentence in half and combining one half with the sentence stating the trio's fields of specialization. Another thing that the reader notices is that Päkkilä has not followed the sentence structure of the original in the second sentence. Instead of simply listing the professions of the three men like the source text does, he varies the structure with each new profession. The reason for this is undoubtedly the fact that in Finnish, a list like that would sound monotonous even though it works fine in English.

In this particular quote, the reader's attention focuses on the term paleomagnetism. It is a branch of geomagnetism, or the study of Earth's magnetic field, with a particular interest in the historical aspect (Geomagnetism and Paleomagnetism 2014). It may be obvious to a reader that this field studies magnetism and, in particular, its historical aspect (hence the prefix paleo-), but what they may not know is that paleomagnetists study the spreading the seafloors and the reversal of the Earth's polarization, evidence for which can be found fossilized in rocks and sediments (ibid.). It is interesting to note that this particular term has been left unexplained even though in popularization explaining the new or difficult terms is crucial. Perhaps it has been left unexplained because Bryson felt that it was not important to know exactly what Walter Alvarez did, only that he was specialized in a field that was not paleontology. However, perhaps explaining the term could have told the reader that Alvarez and his two companions knew something about the matter, even though they describe themselves as amateurs. It is also worth noting that in two different parts of the book (one of which falls outside the scope of my thesis), Bryson does describe paleomagnetism, but he never names the field in question.

Earlier in chapter 4.1, it was established that the explanation of terms is important since the reader of the book is most likely a non-scientist. It cannot, and should not, be assumed that the reader is aware of each and every little detail concerning science, nor

should it be assumed that the reader will look additional information up on his or her own. Certainly, there are readers who will do that, but it cannot be expected that everyone has the time and inclination to find something out on their own. Therefore, it is important that an explanation for something new and difficult is already included in the book; this way, the reader is more likely to continue reading because the content is not too difficult for them to follow. This is the purpose of the popularized material and hence the importance of explained terms.

Yet on the other hand, it is important not to underestimate the reader's knowledge either. As was previously stated, this is not a children's book and thus a certain amount of knowledge can be expected from the reader. Bryson is well aware of this. For instance, when describing the atmosphere, Bryson does not begin by describing that it is comprised mostly of oxygen, with a certain percentage of other chemical elements. Instead, the first sentence in the chapter is "Thank goodness for the atmosphere" (Bryson 2004: 313). Next, he tells the reader why having an atmosphere is a good thing:

(22) ST: It keeps us warm. Without it, Earth would be a lifeless ball of ice with an average temperature of minus 50 degrees Celsius. In addition, the atmosphere absorbs or deflects incoming swarms of cosmic rays, charged particles, ultraviolet rays and the like. Altogether, the gaseous padding of atmosphere is equivalent to a 4.5-metre thickness of protective concrete, and without it these invisible visitors from space would slice through us like tiny daggers. Even raindrops would pound us senseless if it weren't for the atmosphere's slowing drag. (Bryson 2004: 313.)

TT: Se pitää meidät lämpiminä. Ilman sitä Maa olisi eloton jääpallo, jonka keskilämpötila olisi -50 astetta. Lisäksi ilmakehä imee itseensä ja torjuu kosmista säteilyä, suurienergisiä hiukkasia, ultraviolettisäteitä ja sen sellaista. Suojavaikutukseltaan ilmakehän kaasupatja vastaa 4,5 metrin paksuista betonikerrosta, ja jos sitä ei olisi, avaruuden näkymättömät vieraat lentäisivät lävitsemme kuin pienet tikarit. Sadepisaratkin hakkaisivat meidät tajuttomiksi ilman ilmakehän jarruttavaa vaikutusta. (Bryson 2005: 278.)

For the reader of the book, the information presented in example 22 is more important than the exact chemical composition of the atmosphere. As Erkki Karvonen rightfully points out in his editorial in *Tieteessä tapahtuu*, people are interested in what concerns

them personally (Karvonen 2011: 1), and thus it can be said that popularized works often introduce themes that might interest the reader and benefit them in their everyday lives.

Back on the subject of Bryson not over-explaining the terminology, he occasionally tells the reader about the etymology of foreign words, but he does not do so every time there is a foreign-sounding word. While knowing the etymology can be interesting, it can also become tedious for there are many terms in the book. To the reader it is more interesting to know that the troposphere, which contains the vast majority of water in the atmosphere and thus is the place where all weather phenomena occur, is only 10–16 kilometers thick, depending on whether it is measured from the equator or from the poles (Bryson 2004: 314). As Bryson puts it, there is not much between us and the oblivion (ibid.).

Omitting or *replacing* a term with an explanation is also part of the reformation process Calsamiglia and van Dijk mentioned. In a book like *Short History*, however, the omission of terms is not often possible. This is due to the fact that the book is about science and natural history, which means that terms are essential to the book, and their omission would seem unnatural given the circumstances. They still require an explanation, though, which Bryson has provided. Often, this is done by simply adding an explanation after the term, as in this example:

(23) ST: His moment of epiphany came when he realized that a moraine, or line of rocks, near his family estate in Scotland, [...] (Bryson 2004: 509)

TT: Valaistumisen hetki koitti, kun hän tajusi, että moreenikerrostuma, jonka hän oli nähnyt satoja kertoja sukunsa tiluksilla Skotlannissa, [...] (Bryson 2005: 454)

Note, that in the TT, Päkkilä has omitted the explanations from the translation. This is possibly due to him feeling that “moreenikerrostuma” is familiar enough to the Finnish reader and thus requires no additional explanations. Occasionally, however, a subject requires more illumination of it is either difficult or little known to a layman reader, and these clarifications can become long and wordy. Instead of putting long explanations

into the text itself, which could decrease the readability, Bryson often utilizes footnotes to contain the explanation. For example, he did this when he explained the differences between the term hominid and other similar terms, such as hominin (ibid. 523).

As I stated earlier, the explanations can become quite lengthy and wordy and thus can make heavy reading. Therefore, as with any writing aiming to attract a large readership, variation is required to keep the reader interested. As was pointed out above, Bryson uses footnotes to contain the lengthiest explanations, but these, too, can become cumbersome if there are many of them in succession. In some cases Bryson has omitted the word 'or' or another similar word which would signify the beginning of an explanation. While there is nothing wrong with this tactic, it can be confusing if the reader is not paying enough attention to what he or she is reading. I, for one, failed to notice the explanation in this following sentence the first time I read it:

(24) ST: [I]f James Hutton, the eighteenth-century father of geology, had visited Switzerland, he would have seen at once the significance of the carved valleys, the polished striations, the telltale strand lines where rocks had been dumped, and the other abundant clues that point to passing ice sheets. (Bryson 2004: 507)

TT: [J]os geologian isä James Hutton olisi käynyt Sveitsissä, hän olisi tajunnut oikopäätä, mitä merkitsivät kovertuneet laaksot, uurteiset kalliot, siirtolohkareiden sijaintipaikkoihin liittyvät muinaiset rantaviivat ja monet muut mannerjäätiköiden liikkeisiin viittaavat merkit. (Bryson 2005: 452)

Before searching for the term striation, I had been under the assumption that "the polished striations" and the following "telltale strand lines" meant two different things. Yet Oxford English Dictionary defines striation as "one of a set or system of striæ, a streak, a marking; esp. *Geol*. one of the grooves or glacial marks found on rock-surfaces; *Min*. (*pl*.) the fine parallel lines on crystalline face" (Oxford English Dictionary 2014). Therefore, it can be assumed that striations were explained in the following sentence to be "telltale strand lines". However, upon seeing the Finnish translation and searching for the term 'strand line', I came to the conclusion that my initial assumption was, in fact, correct.

In this instance, the Finnish translation is somewhat clearer. If one looks at the TT of the example 24, it becomes obvious that there are some differences between the translation and the original. In Päkkilä's translation there is no doubt about whether something is meant to be an explanation for something else, or if it refers to something else entirely. In Finnish, the translation for 'a striation' is simply 'uurre' (groove) (Rantasalmen Ympäristökasvatusinstituutti 2014). While the source text mentions only 'polished striations', this does not work in the target text since the literal translation 'sileät uurteet' tells nothing to the reader. It is safe to assume the striations can be found in rock or other durable material, as it would not survive long in sand or other similar substance, but other than that, the reader would have been forced to find more information on his or her own, which is not the point of the book. By specifying that the grooves, or striations, are on the surfaces of rocks and cliffs, Päkkilä both keeps the translation stylistically similar to the source text (both are two words long, excluding the article in the source text) and provides an explanation for the reader that is not too long but is sufficiently descriptive.

Moreover, by changing the order of the following line slightly, Päkkilä eliminates the confusion that is so apparent in the original, although it is possible the problems would have been eliminated even if the sentence structure had been left unaltered. This, however, would have affected the readability somewhat so Päkkilä's change is justified. In any case, the sentence begins with 'siirtolohkare' (an erratic) instead of 'the telltale strand lines', which makes it clear that striation and the strand lines refer to two different things.

Small inconsistencies in style aside, Bryson has been able to balance the scientific terms and popular expressions well. One example of this can be found when he describes the so-called 'super ice age'; first he gives the term scientists use (Cryogenian) and then he mentions that this 'super ice age' is popularly known as Snowball Earth (Bryson 2004: 516). Päkkilä, in his part, has chosen a slightly different method, mentioning the 'super ice age' (superjääkausi in Finnish) first and then elaborating that its scientific name is 'kryogeenikausi' (Bryson 2005: 460). As for the Finnish translation for Snowball Earth,

"lumipallomaa" (ibid.), the reader gets an impression from the sentence that it is somewhat rarely used term, when in reality it seems to be in popular usage. It is, in fact, the term used throughout Ari Brozinski's article and refers to a period of time approximately 1,000–542 million years ago when the entire planet was covered in a thick layer of ice (Brozinski 2011).

There are also cases where the English term and the Finnish term are completely different. One such term concerns the latest of the Ice Ages which ended 11 590 years ago (Brozinski 2011). The Finns call this period *Veiksel ice age*, after a river in Poland which in the English-speaking world is known as the Vistula (Hurtta 2006). However, in North America, the ice sheet covering the continent is known as the *Wisconsian ice sheet*, and this is the term that Bryson, having been born in the US, uses (Bryson 2004: 517). However, Päkkilä has opted to use the term Veiksel, because it is more familiar to the Finnish reader, although he has also mentioned the term Wisconsian in case a reader would like to know more about it (Bryson 2005: 462).

Occasionally, Päkkilä has seen the need to clarify a term to the target language reader. For instance, Bryson mentions a term *Younger Dryas* when discussing about a thousand-year long period of cold following the period when the Earth was warming after the latest Ice Age (Bryson 2004: 518). He mentions that the period is named after an Arctic plant which was one of the first to "recolonize" the land after the ice sheets withdrew (ibid.). Obviously, Päkkilä is required to use both the Finnish name of the plant – lapinvuokko – but he also explains to the reader that term *nuorempi dryaskausi* (younger Dryas period) comes from the plant's Latin name *Dryas octopetala* (Bryson 2005: 463).

4.3 Audience design and popularization

Earlier, I have examined usability and popularization separately. In this section, I will analyze them together and argue for my claim that the two theoretical frameworks I am using in this thesis are closely linked with one another.

Consider this quotation:

(25) ST: A molecule is simply two or more atoms working together in a more or less stable arrangement: add two atoms of hydrogen to one of oxygen and you have a molecule of water. Chemists tend to think in terms of molecules rather than elements in much the way that writers tend to think in terms of words and not letters, so it is molecules they count, and these are numerous to say the least. (Bryson 2004: 175.)

TT: Molekyyli koostuu kahdesta tai useammasta atomista, jotka esiintyvät yhdessä enemmän tai vähemmän pysyvänä yksikkönä: kun kaksi vesiatomia ja yksi happiatomi yhdistetään, tuloksena on yksi vesimolekyyli. Kemisteillä on tapana keskittyä pikemminkin molekyyleihin kuin alkuaineisiin samaan tapaan kuin kirjoittajat ajattelevat yleensä sanoja eivätkä kirjaimia. Siksi kemiassa käsitellään molekyylejä ja myös niitä on vähintäänkin valtavasti. (Bryson 2005: 152.)

Here, Bryson makes a comparison between chemists and writers: how neither really concern themselves with the smaller units (atoms in the case of chemists and letters in the case of writers), but rather focuses on what those smaller units form when banded together. Even though Bryson is no expert when it comes to scientific matters, he has published several bestsellers before writing *Short History* and therefore it could be argued that he is able to recognize how similar chemists and writers are in this aspect. The quote above also demonstrates how Bryson has seen the need to define the term *molecule* for the reader, but without sounding condescending or lecturing to someone who already knows the definition. It is merely expressed as a statement and left at that.

Given that example 25 is taken from what is possibly the most difficult chapter in the entire book, it is worth taking a closer look at its contents. As the quote shows, this chapter concentrates on the discovery of atoms. In the midst of explaining the more technical aspects of the atom, Bryson introduces some of the people who first discovered the atom and helped to shed light on its mysteries; among those people are John Dalton, Ernest Rutherford and Werner Heisenberg. All of these men had their own quirks and peculiarities – Dalton was a Quaker and had been put in charge of a local Quaker school at the age of twelve (Bryson 2004: 177), Rutherford, while undoubtedly a genius, was a poor mathematician and frequently his own equations managed to

confuse him (ibid. 180), and Heisenberg did not fully understand the theory he himself created (ibid. 188). In spite of such shortcomings, all of them made it possible to understand the atom slightly better.

What makes this chapter so difficult is that physicists themselves struggled to fully understand the concept of an atom. For one, an atom is so small that to observe it the scientists had to use other means, such as firing ionized helium atoms at a sheet of gold foil and observing what happened, like Rutherford did (Bryson 2004: 183). Since most of Rutherford's helium atoms passed right through the gold foil, it was revealed that an atom was not a solid object, as had been previously assumed. This, however, was not what surprised Rutherford the most. To show what precisely surprised Rutherford so much and to demonstrate what it means, Bryson quotes Rutherford making a following comparison:

(26) ST: To [Ernest] Rutherford's amazement, some of the particles bounced back. It was as if, he said, he had fired a 15-inch shell at a sheet of paper and it rebounded into his lap. This was just not supposed to happen. (Bryson 2004: 183.)

TT: Rutherfordin ällistykseksi osa hiukkasista kimposi takaisin. Hän vertasi tulosta tilanteeseen, jossa viisitoistatuumainen kranaatti kimpoaa vessapaperista. Sellaista ei yksinkertaisesti pitänyt tapahtua. (Bryson 2005: 159.)

Example 26 describes well how unexpected Rutherford's finding was. Yet, based on his experiment, Rutherford came to the conclusion that an atom had to possess a solid core, but this presented a new problem; based on Rutherford's experiment, an atom should not exist in the first place.

To better illustrate this problem, Bryson moves momentarily away from the Rutherford experiment and the impossibility of an atom and tells the reader instead what today's scientists know about the atom and its structure. It may come as a surprise to some readers that the popular image of the electrons orbiting around the nucleus like planets around the sun is, in fact, false. Bryson notes that if an atom could be seen, it would resemble a "fuzzy tennis ball" instead of a "hard-edged metallic sphere" (Bryson 2004:

189). Rather than revolving around the nucleus on a clearly defined orbit, the electrons are “more like the blades of a spinning fan, managing to fill every bit of space in their orbits simultaneously”, as Bryson puts it (ibid.) (see also example 29 below).

It was Danish Niels Bohr who first presented the theory for how the electrons could keep from crashing into the nucleus. According to him, the electrons occupy certain well-defined orbs; moreover, they have the ability to move from one orb to another without visiting the space between. This theory is called the quantum leap and, in the words of Bryson, it is “too good not to be true” because it explains practically everything about the puzzling behavior of the electrons. (Bryson 2004: 186.) It could not, however, explain why the electron behaved on one occasion like a particle and like a wave the next. This problem was solved in 1926, when Werner Heisenberg, a German physicist, produced a theory known as quantum mechanics, which is partially based on Heisenberg’s Uncertainty Principle. According to this theory, we can know either the path the electron moves in space or its location at that precise moment, but we cannot know both at once. (ibid. 187–188.)

Many physicists, including Albert Einstein, disliked the new quantum theory immensely, partially because it meant that there had to be two sets of laws of the universe, one for the for the very large scale events and one for the very small. Einstein, for instance, spent the rest of his life trying to find a way to connect the two sets of laws together without any success. (Bryson 2004: 192.) It seems as though the mystery of the electron had finally been solved, but it was still unknown why the nucleus of the atom did not explode, and with this, we return to Rutherford’s problem.

As the reader knows, the nucleus of the atom consists of protons and neutrons. Protons are charged positively, while electrons are charged negatively while neutrons have no charge at all (hence the name). It is also known that an atom has an equal number of protons and electrons and this is what so confused the early 20th century physicists. Because of the positive charge of the protons in the nucleus, it was initially unknown how the nucleus was able to exist without blowing itself up. Rutherford proposed a theory that there must be something else in the nucleus as well, something that offsets

the positive charge. His colleague, James Chadwick, set to prove Rutherford's theory and finally succeeded in 1932, after eleven years of research. (Bryson 2004: 187.) He might have succeeded earlier, but as it was, the physicists were occupied with trying to understand the strange behavior of the electrons. Bryson feels that this was a good thing; after all, the understanding of neutrons was vital for the development of the atomic bomb (ibid. 187).

The reason I have brought this matter up is that this passage illustrates well how popularization works as a form of usability. As can be seen from the overview above, Bryson has done his best to make the difficult subject understandable to the reader who might not have contemplated the composition of an atom since leaving school. While the quantum leap and quantum mechanics sound almost like science fiction, Bryson's attempts to explain them deserve credit. He illustrates the peculiar behavior of the electrons as follows:

(27) ST: These [the spectrum readings of the wavelengths of hydrogen] produced patterns showing hydrogen atoms emitted energy at certain wavelengths but not others. It was rather as if someone under surveillance kept turning up at particular locations but was never observed travelling between them. (Bryson 2004: 186.)

TT: Niiden mukaan vetyatomit säteilevät energiaa tietyillä taajuuksilla, mutta eivät kaikilla. Tilanne on samantapainen kuin jos varjostuksen kohteena oleva henkilö nähtäisiin joissakin tietyissä paikoissa, mutta ei koskaan paikkojen välissä. (Bryson 2005: 162.)

The metaphor of a person turning up in certain places but is never seen travelling to them is an apt description for the quantum leap. However, it also makes it sound suspiciously like teleportation. It should be noted, though, that Bryson never calls it by that name or even implies that that is what the electrons do when switching orbits as that would not be scientific in the least and would lessen the credibility of the book.

If we turn to this passage which I have already partially quoted above we notice the attempt to explain a difficult subject by comparing it with something ordinary, a common popularization tactic:

(28) ST: [E]lectrons are not like orbiting planets at all, but more like the blades of a spinning fan, managing to fill every bit of space in their orbits simultaneously (but with the crucial difference that the blades of a fan only *seem* to be everywhere at once; electrons *are*). (Bryson 2004: 185)

TT: [E]lektronit eivät muistuta lainkaan Aurinkoa kiertäviä planeettoja vaan pikemminkin pyörivän tuulettimen siipiä, jotka täyttävät joka hetki kiertoratansa kaikki pisteet (sillä olennaisella erolla, että tuulettimen siivet vain näyttävät olevan joka paikassa yhtä aikaa, kun taas elektronit tosiaan ovat kaikkialla). (Bryson 2005: 161)

Everyone has seen the blades of a fan; they indeed appear to be everywhere at once, even though we know that is not the case and that there are only a limited number of the blades. It is also a very vibrant image and helps the reader to envision what the electron cloud around the nucleus is like.

The only notable difference between the ST and TT of example 28 is the visible lack of emphasis on the content in the parentheses; however, it is replaced by the word "tosiaan [truly]" to stress between the blades of the fan and electrons. Moreover, Päkkilä's translation of this chapter is similar in style to the source text. He, too, has made an effort to keep the content understandable to the reader even though the subject at hand is by no means easy for someone who is not familiar with the peculiarities of an atom. The subject does force the reader to focus on reading, perhaps even read the same passage several times to truly understand what the author is trying to say. It helps that the difficult part is not lumped together into a huge block of text. Instead, in between the scientific aspect there is information about those involved in describing the atom and finding the theories that govern its behavior, including the aforementioned Dalton, Rutherford and Heisenberg. It provides a bit of levity for what is otherwise a heavy subject, even though there are those who criticize Bryson for focusing too much on the eccentricities of the researchers (see, for instance, Dupuis 2010).

Based on this, it can be said that Bryson's aim is to bring his subject closer to the reader. Granted, the knowledge about the structure of atoms is unlikely to benefit the reader in their everyday life, yet given how everything around us is composed of atoms, it is

therefore important that the reader can at least name the key components of an atom and know what their function is. It may not be important for the reader to know what, exactly, a quantum leap is, yet they should know that such a theory exists and it was created in the early 20th century.

It is clear that Bryson has a good idea about what his readers will find interesting. In addition to the atom, which is included because its structure and behavior are some of the most important discoveries of the late 19th and early 20th century, the book also includes several chapters on the dangers of our planet. I, at least, have always found volcanoes, earthquakes, tsunamis and other forces of nature highly interesting. Volcanoes, in particular, are intriguing. No doubt the fascination with such things arises from their destructive power, even beauty. There are several storm hunters in the US, chasing after tornadoes despite the dangers they pose; there are even storm hunters in Finland, although they do not always go after to the most powerful forces of nature (Tähtitieetellinen yhdistys Ursa 2014). In any case, the more dangerous aspects of our planet tend to fascinate people, and therefore it is logical to pay close attention to such matters as Bryson has done.

Another subject that readers are likely to find interesting is the concept of extinction. Bryson already briefly visited the subject in the chapter *Stone Breakers* which primarily deals with the birth of geology. He examines the subject more thoroughly in a later chapter which falls outside the scope of this thesis and therefore I shall not examine it in any detail. Sufficient to say, however, that this subject is bound to draw the reader's attention.

A subject which is within the scope of my thesis and is also likely of interest to the reader is the early humans. In the recent years, plenty of new knowledge has been discovered which has shuffled the human family tree around quite a bit. It has, for example, been suggested that "Lucy", as the famous *Australopithecus afarensis* fossil is called, is not the progenitor of the modern human, *Homo sapiens*, after all, but belongs to a completely different branch in the family tree (Valste 2013: 28). Bryson's book, however, was written before this new information was revealed in 2005, which is why

Australopithecus afarensis is still named as the earliest known ancestor of the human race. Even so, given the controversial nature of the subject, the readers will most likely find the chapter *The Mysterious Biped* and the chapters following it of interest. Indeed, Bryson devotes a considerable amount of time for the debate surrounding the discoveries of Neanderthals and other early humans.

I believe that the reader is not surprised to find out that the vast majority of the controversy surrounds the disbelief that there could have been more than one species of humans. It was long believed that the human race was the pinnacle of evolution – the crown jewel of nature – and therefore the early reconstructions of our family tree was really nothing but a single line, with very few side branches, with us on the top. Humans were believed to be the perfect example of how species gradually evolved linearly from a simple base form into a more complex one. (Valste 2013: 24.) Yet as more and more fossils were discovered, it became increasingly difficult to fit the new species into the linear model, which, understandably, frustrated the early 20th century anthropologists and paleontologists.

Again, I believe that the reader will not be surprised that the notion that humans might have evolved in Africa was widely rejected. During the time the first early human remains were discovered in Africa, in the 1920s, it was believed that human and ape evolutionary lines had split apart 15 million years ago in Asia. Bryson likens this new discovery to someone finding today early human remains in Missouri; that would not fit with what is currently known about our origins, the same way that the new African remains, named *Australopithecus africanus* by its finder Raymond Dart, did not fit with what was known at the time. (Bryson 2004: 526.)

While none of this is truly new information (save for, perhaps, the names of the people involved), Bryson's humane approach and the focus on the personalities involved instead of the numerous early humans creates a whole new perspective. This is especially true for the source text where the Latinate names are used (e.g. *Homo erectus*, *Homo heidelbergensis*, *Australopithecus afarensis*, *Australopithecus transvaalensis*, etc.), with the occasional English-language name (e.g. the Java Man, the Peking Man,

etc.). This is a language custom, but it does make it somewhat difficult to differentiate the early humans from each other. Interestingly enough, Päkkilä has chosen to follow this custom as well, even though most of the species known today have had their names translated into Finnish. In my personal opinion, it might have been better to use the accepted Finnish names as they would have been easier to remember. As it is, the casual reader might keep mixing the numerous Latin names; most of them are, however, easy enough to understand so the reader will not be left wondering about the etymology of the name.

Based on the above discussion, I have attempted to demonstrate that popularization and usability are heavily intertwined in both the *Short History* and *Lyhyt historia*. It cannot be said that this is the case with all popular literature; a more comprehensive study is needed to make such a claim. However, this seems to certainly be the case with my material. In a way, it is not surprising; popularized texts are modified to suit the needs of the receiver, whoever they may be. The message should be composed on the receivers' terms, as Karvonen puts it (Karvonen 2011). This ties to Bell's theory of the speaker always modifying his speech based on who the message is aimed at. It goes without saying that the speaker may decide for themselves who the receivers are. As Calsamiglia and van Dijk state, popularization involves "various strategies of explanation, such as definitions, examples, or metaphors, among many others" (Calsamiglia and van Dijk 2004: 370). In other words, the information must be reformatted so that a person without any specialized training can comprehend it. Every change that is made should be for the user's benefit. This can be difficult if the person writing the popularized text is an expert since they are already familiar with the subject and may not identify the more difficult parts. Similarly, someone not familiar with the subject may over-simplify the subject because it is difficult for them.

To summarize, popularization and usability have several features in common, and in my material, the two seem to be intertwined. Bryson's aim was to write a book that can be read by anyone interested in the history of natural science and possibly learning something new from it. It seems that he has had a clear vision of who his intended readers are, quite possibly because he himself would fall into that category if someone

else had written such a book. Bryson is very conscious of the fact that even some of the most basic aspects may be unfamiliar to some of his readers and therefore he strives to include a brief overview of the concept every time he discusses a new subject. Such an approach may alienate those readers who are already familiar with the subject, which means that Bryson must also include something to keep those readers interested. The humor of the book is one example of attracting a wide readership, the inclusion of less-known researchers another. Most likely Bryson's experience as an author helps him to identify the themes and subjects his readers would find most interesting. All in all, the book has been well-receiver amongst the readers, which speaks for how successful the popularization has been and how well the user has been taken into account when the book was written.

5 CONCLUSION

In this thesis I have discussed popularization and usability in Bill Bryson's book *A Short History of Nearly Everything* and its Finnish translation *Lyhyt historia lähes kaikesta* (translated by Markku Päkkilä). I was particularly interested in the following research questions: "Are there different levels of popularization between the source text and the target text?" and "How do the texts take the user into account?" I used Alan Bell's audience design as the theoretical framework for usability. As for popularization, I focused mainly on two particular strategies, humor and the addition and omission of terms because they emerged strongly from the material. I used heuristic evaluation as a method because I myself was the sole analyst and I was relying on my knowledge of popularized literature. In addition, I conducted a brief interview with the translator Markku Päkkilä via LinkedIn in order to gain insight to some of the questions about the translation.

I had hoped to do a survey to get different perspectives for the second question, but due to the lack of responses, I had to leave the survey out of the thesis. Most likely the survey failed because the subject was so unfamiliar to the people I sent the questions to that they did not want to answer in fear of providing incorrect answers. It is also possible that the survey was too long for the respondents and they did not answer because they did not have the time to do so. Even though the survey failed, I still learned about the process of making a survey. If I continue researching popularization and usability, I will make a revised version of the survey and hopefully acquire the answers I could not get this time.

As I wrote this thesis, I discovered that usability and popularization were intertwined in my material. In a way, it is not surprising since the aim of popularization is to simplify and make scientific information more accessible to the general public. One of the Finnish names for popularization, *kansantajuistaminen* [popularization, literally making something understandable for the people] reflects this goal well. Bill Bryson admits at the beginning of the book that he is no expert, and before he began the writing process, he knew nothing about the planet. Bryson wanted to write a popular science book

because the textbooks he used at school were not interesting and he felt that there was some agreement between the authors to withhold any information that the students might find interesting (Bryson 2004: 22). The book, therefore, was written for two reasons: one, so that Bryson could remedy years of ignorance, and two, to see if it was possible to write about science in a way that was both enjoyable and educational.

Popularization is characterized by several features, such as the tendency to bring the author into the spotlight, to simplify the content and to present it in a form that is easy and memorable to the reader. Some of the techniques popularization uses are humor, comparing something difficult with something ordinary and omissions, additions or replacements. Bryson uses all of these in his writing, particularly humor. Before writing the *Short History*, he wrote several critically acclaimed books and therefore was aware of how to best keep the reader interested and reading. I discovered that Bryson uses the humor partially to make the content more memorable. As is the case with history books, the *Short History* is full of names and dates and other details which often repeated in the book but which the reader possibly could not remember. Therefore Bryson used humor as a tool to remind the reader of the things he or she already read.

Markku Päkkilä, the Finnish translator, followed Bryson's principle in the translation and kept the target text close to the source text. The only differences that I discovered are due to the need to change the text to better accommodate the needs of the target language audience. Päkkilä has, for instance, slightly changed the joke when a literal translation would not have made sense to the reader, or he has added an explanation where one was needed for the user to better appreciate the text. I hypothesized that the source text and the target text are at the same level of popularization and this preliminary hypothesis was proven correct. Päkkilä even stated that the reader the book was aimed at was "written in" in the book and it was not possible for him to deviate from that (Päkkilä 2015).

I also discovered that Bryson's intended audience, the *addressees*, were most likely the kind of readers he himself would identify with; those who are very unfamiliar with the history of natural sciences and the planet and would like to learn more. However, I

came to the conclusions that the *auditors*, who are below the addressees in Bell's categorization, might be more important in my material because in all likelihood they form the majority of the readers. Therefore much of the humor was catered towards them. In other words, the humor in the books was not only used to make the content more memorable, it was also used to keep the readers interested.

To summarize, there were some differences between the source text and the target text, but these were caused by the differences between the source language and the target language. It cannot be said that there were different levels of popularization. The user had been taken into account by adding explanations and using humor to make the subject more memorable. In fact, I discovered that in the *Short History* and *Lyhyt historia*, popularization and usability were intertwined. I attributed this to the fact that popularization is all about bringing science and research closer to the general public, and rewording it so that it is easier for laymen to comprehend. While the intended audience, the addressees, was determined to be those laymen who have had very little contact with science prior to reading the book, I believed that the auditors, or the group of readers who the author is aware of and ratified, but not directly addressed, were more important than the addressees because they are likely to provide a larger readership. Therefore it became clear that the auditors needed something to keep them interested, and that something was humor. All in all, the popularization in this book is achieved in a way that renders the information both accessible and interesting.

It should be noted, however, that this thesis has only a limited scope. My material was collected only from a single book and its translation, and additionally I chose to include only a limited number of chapters. Moreover, as Jakob Nielsen points out, doing a heuristic evaluation is difficult for only a single analyst since it is improbable that a one person will be able to identify every usability problem in the material (Nielsen 1995). Therefore it could be possible for someone else to continue this thesis and identify the problems I have not noticed. Another possibility is to use the chapters I did not include in the thesis as material and find out if there are other usability problems in addition to the ones I discovered while analyzing my material.

In the future, it would be interesting to find out if popularization and usability are as intertwined in other popular science literature as they appear to be in the *Short History of Nearly Everything* and its Finnish translation. If the similarities between popularization and usability which in my opinion can be found in *Short History* are discovered in other popular science books as well, this knowledge could be applied in practice in at least three different ways. Firstly, the usability of popular science books could be further enhanced if the most common usability problems, should there be any, are identified. Secondly, if the hypothetical usability problems are erased, it might be possible to find new ways to popularize scientific content and thus further develop the study of popularization. Finally, if new possible ways to popularize are created, perhaps it would possible to encourage more scientists and researchers to take up popularization and thus further develop the field.

WORKS CITED

Primary sources:

Bryson, Bill (2004). *Short History of Nearly Everything*. London: Black Swan Books

Bryson, Bill (2005). *Lyhyt historia lähes kaikesta*. (Transl. by Markku Päkkilä.) Helsinki: Werner Söderström Osakeyhtiö

Secondary sources:

Alenius, Jyrki (2005). Bill Bryson sujuvasti kaiken kimpussa. Kirja luonnontutkimuksen historiasta ja nykytuloksista yhdistää asian ja trivian. [Bill Bryson tackles everything effortlessly. The book about the history and modern findings of natural sciences combines fact and fiction.] [Cited 21.6.2014] Available at: http://www.hs.fi/kulttuuri/a1353060179779

Alliance of Audited Media (2013). "Total Circ." [Cited 3.5.2014] Available at: http://abcas3.auditedmedia.com/ecirc/magtitlesearch.asp

American Museum of Natural History (2014). "Staff Profiles: Ian Tattersall." [Cited 7.8.2014] Available at: http://www.amnh.org/our-research/staff-directory/ian-tattersall

Auckland University of Technology (2012). "Our Staff. Professor Allan Bell." [Cited 2.6.2014] Available at: http://www.aut.ac.nz/research/research-institutes/icdc/people/professor-allan-bell

Bacon, Josephine (2002). "Scientific Translation and Interpreting – Bright Career Prospects." [Cited 6.8.2014] Available at: http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2002_05_10/nodoi.946767809007790000

BBC News (2003). Bryson tops 'England' poll. [Cited 6.10.2015] Available at: http://news.bbc.co.uk/2/hi/entertainment/2824715.stm

Bell, Allan (1984). "Language Style as Audience Design". [Cited 2.6.2014] Available at: http://www.stanford.edu/~eckert/PDF/bell1984.pdf

Bell, Allan (2001). "Back in Style: Reworking Audience Design." In *Style and Sociolinguistic Variation*. Eds. Penelope Eckert and John R. Rickford. Cambridge: Cambridge University Press. 139–169.

Bensaude-Vincent, Bernadette (2001). "A Genealogy of the Increasing Gab Between Science and the Public." [Cited 20.6.2014] Available at: http://pus.sagepub.com.proxy.tritonia.fi/content/10/1/99.full.pdf+html

Blanning, Tim (2008). *The Pursuit of Glory. Europe 1648–1815*. London: Penguin Books Ltd.

Bortulus, Alejandro (2012). "Running like Alice and Losing Good Ideas: On the Quasi-Compulsive Use of English by Non-native English Speaking Scientists." [Cited 24.9.2015] Available at: http://link.springer.com.proxy.tritonia.fi/article/10.1007/s13280-012-0339-5/fulltext.html

Brozinski, Ari (2011). "Lumipallomaa [Snowball Earth]". [Cited 3.8.2014] Available at: http://www.geologia.fi/index.php/2011-12-21-12-58-39/2011-12-21-13-00-04/lumipallomaa

Bucchi, Massimiano (2008). "Of Deficits, Deviations and Dialogues: Theories of Public Communication of Science." In *Handbook of Public Communication of Science and Technology*. Eds. Massimiano Bucchi and Brian Trench. London: Routledge. 57–77.

Calsamiglia, Helena & Carmen López Ferrero (2004). "Role and Position of Scientific Voices: Reported Speech in the Media". [Cited 6.8.2014] Available at: http://dis.sagepub.com.proxy.tritonia.fi/content/5/2/147

Calsamiglia, Helena & Teun A. van Dijk (2004). "Popularization Discourse and Knowledge about the Genome." [Cited 8.6.2014] Available at: http://das.sage pub.com.proxy.tritonia.fi/content/15/4/369.full.pdf+html

Cornelis, Gustaaf C. (1998). "Is Popularization of Science Possible?" [Cited 6.8.2014] Available at: https://www.bu.edu/wcp/Papers/Scie/ScieCorn.htm

Downs, Roger M. (2010). "Popularization and Geography: An Inseparable Relationship." [Cited 16.4.2014] Available at: http://web.b.ebscohost.com.proxy.tritonia.fi/ehost/detail?vid=4&sid=cc748447-3c1b-4f3c-a7b1-0b8152197e40%40sessionmgr110&hid=119&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=afh&AN=49234135

Dupuis, John (2010). "From the Archives: A Short History of Nearly Everything by Bill Bryson." [Cited 21.6.2014] Available at: http://scienceblogs.com/confessions/2010/11/27/from-the-archives-3/

Euroopan integraatio (1996). "Koneiden, laitteiden ja tuotteiden käyttöohjeet." [The manuals for machines, equipment and products.] Integraatiotiedote 22. Metalliteollisuuden keskusliitto.

European Commission (2006). "Six years of Descartes Prize winners. Excellence in scientific collaborative research and science communication." [Cited 6.10.2015] Available at: https://ec.europa.eu/research/science-awards/pdf/6_years_descartes_en.pdf

Geology for Global Development (2013). Interview: Jonathan Amos, BBC Science Correspondent. [Cited 6.8.2014] Available at: http://blogs.egu.eu/gfgd/2013/04/15/interview-jonathan-amos-bbc-science-correspondent/

Geomagnetism and Paleomagnetism (2014). "Research." [Cited 3.8.2014] Available at: http://geopaleomagnetism.agu.org/research/

Gieryn, Thomas F. (1983). "Boundary-work And the Demarcation of Science from Non-science: Strains and Interests in Professional Ideologies of Scientists." [Cited 16.6.2014] Available at: http://www.jstor.org.proxy.tritonia.fi/stable/pdfplus/2095325.pdf?acceptTC=true&jpdConfirm=true

Gill, Paul, Kate F. Stewart, Elizabeth T. Treasure & Barbara Lesley Chadwick (2008). "Methods of Data Collection in Qualitative Research: Interview and Focus Groups." [Cited 1.10.2015] Available at: http://www.researchgate.net/publication/5495328_Methods_of_data_collection_in_qualitative_research_Interviews_and_focus_groups

Hirsjärvi, Sirkka, Pirkko Remes & Paula Sajavaara (2009). *Tutki ja kirjoita* [*Study and write*]. 15th ed. Helsinki: Tammi.

Hogue, Bev (2011). "I'm Not Making This Up. Taking Humor Seriously in the Creative Nonfiction Classroom." [Cited 3.8.2014] Available at: http://web.b.ebscohost.com.proxy.tritonia.fi/ehost/pdfviewer/pdfviewer?sid=2b91e5fe-6195-4fee-a244-0b62e0444b4b%40sessionmgr115&vid=1&hid=106

Huffington Post (2014). "Sharon Hrynkow PhD." [Cited 23.8.2014] Available at: http://www.huffingtonpost.com/sharon-hrynkow-phd/

Immediate Media Company (2014a). "BBC Focus Magazine." [Cited 3.5.2014] Available at: http://www.immediate.co.uk/brands/focus/

Immediate Media Company (2014b). "BBC Sky at Night Magzine." [Cited 3.5.2014] Available at: http://www.immediate.co.uk/brands/bbc-sky-at-night/

Institute for the Languages of Finland (2010). "Vetoomus suomen kielen aseman turvaamiseksi tieteen ja korkeimman opetuksen kielenä." [Appeal for securing Finnish as the language of science and education of the highest degree.] [Cited 22.6.2014] Available at: http://www.kotus.fi/files/1429/Vetoomus_lautakunta_2010.pdf

Karala, Maija (2015). "Pilkattu tutkimus tekee läpimurtoja." [Mocked research creates breakthroughs] *Tiede* 3/2015, 22–29.

Karvonen, Erkki (2011). “Viestintätaidot ja tiedeviestintä 2.0” [Communication skills and science communication 2.0] [Cited 3.8.2014] Available at: http://ojs.tsv.fi/index.php/tt/article/view/4002/3758

Karttunen, Hannu (2006). “Epätarkka esitys vähän kaikesta.” [Inaccurate representation of nearly everything.] [Cited 21.6.2014] Available at: http://www.tieteessatapahtuu.fi/0206/karttunen.pdf

Kiikeri, Mika & Petri Ylikoski (2004). *Tiede tutkimuskohteena. Filosofinen johdatus tieteentutkimukseen*. [*Researching Science. Philosophical Introduction to Science Studies*.] Helsinki: Gaudeamus.

Levikintarkastus Oy (2014). “Levikkihaku.” [Circulation search.] [Cited 3.5.2014] Available at: http://www.levikintarkastus.fi/levikkitietokanta/index.php

Liao, Min-Hsiu (2013). “Popularization and Translation.” In *Handbook of Translation Studies, Volume 4*. Eds. Yves Gambier and Luc van Doorslaer. Amsterdam: John Benjamins Publishing Company. 130–133.

LinkedIn (2015). “Markku Päkkilä.” [Cited 19.1.2015] Available at: https://www.linkedin.com/profile/view?id=54757699&authType=NAME_SEARCH&authToken=yGoh&locale=en_US&trk=tyah&trkInfo=tarId%3A1421669172887%2Ctas%3AMarkku%20P%C3%A4kk%2Cidx%3A1-1-1

Montgomery, Scott L. (2000). *Science in Translation. Movements of Knowledge Through Cultures and Times*. Chicago: The University of Chicago Press.

Montgomery, Scott L. (2009). “English and Science: realities and issues for translation in the age of an expanding *lingua franca*.” [Cited 22.6.2014] Available at: http://www.jostrans.org/issue11/art_montgomery.php

Montgomery, Scott L. (2010). “Scientific Translation.” In *Handbook of Translation Studies, Volume 1*. Eds. Yves Gambier and Luc van Doorslaer. Amsterdam: John Benjamins Publishing Company. 299–305.

Myers, Greg (2003). “Discourse Studies of Scientific Popularization: Questioning the Boundaries.” [Cited 9.6.2014] Available at: http://dis.sagepub.com.proxy.tritonia.fi/content/5/2/265

Nielsen, Jakob (1995). “How to Conduct a Heuristic Evaluation.” [Cited 29.9.2015] Available at: http://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/

Oxford English Dictionary (2014). “Striation, *n.*” [Cited 3.8.2014] Available at: http://www.oed.com.proxy.tritonia.fi/view/Entry/191556?redirectedFrom=striation#eid

Paul, Danette (2004). “Spreading Chaos: The Role of Popularization in the Diffusion of Scientific Ideas.” [Cited 20.6.2014] Available at: http://wcx.sagepub.com.proxy.tritonia.fi/content/21/1/32

Pilegaard, Morton (1997). “Translation of Medical Research Articles.” In *Text Typology and Translation*. Ed. Anna Trosborg. Amsterdam: John Benjamins Publishing Company. 159–184.

Pohjoispää, Monika (2015). “Tutkija tarraa sattumaan kuin Serendipin prinssi.” [Researcher grabs on to a coincidence like the prince of Serendip] *Tiede* 1/2015, 36–43.

Rantasalmen Ympäristökasvatusinstituutti (2014). “Maiseman tarina.” [The story of the landscape] [Cited 3.8.2014] Available at: https://www2.uef.fi/documents/1347235/1368086/Maiseman+tarina.pdf/30430682-894f-431a-a47c-25335797df58

Root-Bernstein, Meredith & Richard J. Ladle (2014). “Multilinguismo nas ciências ambientais: Ahora ya! (Multilingualism in Environmental Sciences: It’s About Time!)” [Cited 24.9.2015] Available at: http://link.springer.com.proxy.tritonia.fi/article/10.1007/s13280-014-0531-x/fulltext.html

Royal Society (2006). “Survey of factors affecting science communication by scientists and engineers.” [Cited 3.8.2014] Available at: https://royalsociety.org/~/media/Royal_Society_Content/policy/publications/2006/1111111395.pdf

Royal Society Winton Prize for Science Books (2015). “Royal Society Winton Prize for Science Books: All winners, shortlisted and longlisted.” [Cited 6.10.2015] Available at: https://docs.google.com/spreadsheets/d/1T2Ec5KacJ4p2IWWz6m4RUbZhTlT-LOfEvqWlzrAAq5I/edit?pli=1#gid=0

Saaranen-Kauppinen, Anita & Anna Puusniekka (2006a). ”5.5 Tapaustutkimus.” [5.5 Case Study Research.] [Cited 30.4.2014] Available at: http://www.fsd.uta.fi/menetelmaopetus/kvali/L5_5.html

Saaranen-Kauppinen, Anita & Anna Puusniekka (2006b). ”6.3 Haastattelu.” [6.3 Interview.] [Cited 29.9.2015] Available at: http://www.fsd.uta.fi/menetelmaopetus/kvali/L6_3.html

Saaranen-Kauppinen, Anita & Anna Puusniekka (2006c). ”6.3.1 Avoin haastattelu” [6.3.1 Unstructured Interview.] [Cited 1.10.2015] Available at: http://www.fsd.uta.fi/menetelmaopetus/kvali/L6_3_1.html

Sagan. Writ. Tuomas Holopainen. Prod. Tuomas Holopainen, Mikko Karmila, Tero Kinnunen, Mika Jussila (2014). [CD] Nuclear Blast 2015.

Stichweh, Rudolf (2003). "The Multiple Publics of Science: Inclusion and Popularization." [Cited 6.8.2014] Available at: www.4science.cz/read/document/68

Strevens, Peter (1992). "English as an international language: Directions in the 1990s." In *The Other Tongue: English Across Cultures*. Ed. Braj B. Kachru. 2nd ed. Urbana: University of Illinois Press. 27–47.

Suojanen, Tytti, Kaisa Koskinen & Tiina Tuominen (2012). *Käyttäjäkeskeinen kääntäminen*. [User-Centered Translation.] [Cited 16.4.2014] Available at: http://urn.fi/URN:ISBN:978-951-44-8839-9

The Finnish Association of Translators and Interpreters SKTL (2014). "J. A. Hollo." [Cited 29.7.2014] Available at: http://www.sktl.fi/liitto/palkinnot/j-a-hollo/

Turun Sanomat (2006). "Anu Partanen ja Markku Päkkilä palkittiin." [Anu Partanen and Markku Päkkilä were awarded.] [Cited 17.4.2014] Available at: http://www.ts.fi/kulttuuri/1074112555/Anu+Partanen+ja+Markku+Pakkila+palkittiin

Tähtitieteellinen yhdistys Ursa (2014). "Myrskybongaus." [Storm chasing.] [Cited 25.3.2015] Available at: https://www.ursa.fi/harrastus/jaostot/myrskybongaus/yleista-jaostosta.html

Valste, Juha (2013). "Solmuja sukupuussa." [Knots in the family tree.] *Tiede* 4/2013. 22–31.

Waller, John (2003). "Everything you've ever wanted to know (but didn't dare to ask)." [Cited 21.6.2014] Available at: http://www.theguardian.com/books/2003/jun/21/billbryson.scienceandnature

Zabalbeascoa, Patrick (2005). "Humor and translation – an interdiscipline". [Cited 3.8.2014] Available at: http://web.b.ebscohost.com.proxy.tritonia.fi/ehost/pdfviewer/pdfviewer?sid=b5a50d48-8c96-4f11-a783-6070e63eb1ad%40sessionmgr114&vid=1&hid=106

Unpublished sources:

Päkkilä, Markku (2015). Unpublished interview held via LinkedIn in 17.2.2015