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Backward time travel and its relevance for theological study

An explorative literature study based on physics,
philosophy, counterfactual thinking and theology

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ABSTRACT (English)

This paper explores the possibility and relevance of theological study of backward time travel and its consequences. An examination of current research on backward time travel reveals a number of interdisciplinary topics which are not handled within physics. Some of these topics, mainly concerning free will and determination, are of interest to philosophers, whereas topics such as meaning and responsibility are left aside. In theology, there is a general dismissal of the idea of backward time travel. This study claims that this negative stance may be the result of taking science and its methods too seriously. The result of the study is that the interdisciplinary questions connected to backward time travel makes the subject very relevant for theological reflection. Thought experiments on backward time travel can provide valuable insights on how we deal with our lives, our world, time, and God today.

Key words: backward time travel, science, physics, theology, relativity theory, logical paradoxes, thought experiment, counterfactual thinking, post hoc prayer, meaning, co-creation, responsibility, memory, relation, process theology.

ABSTRAKT (svenska)

Denna explorativa studie utforskar möjligheten och relevansen av teologiska studier av tidsresor till det förflutna och deras konsekvenser. En undersökning av det aktuella forskningsläget visar på förekomsten av interdisciplinära frågeställningar som inte hanteras inom fysiken. Vissa frågor, framförallt knutna till den fria viljan och determinism, intresserar filosofer, medan andra områden som mening och ansvar inte behandlas vidare. Teologer ställer sig generellt negativa till tanken på resor till det förflutna. Denna studie hävdar att denna negativa inställning kan vara resultatet av en alltför stark respekt för vetenskapens fynd och metoder. Resultatet av studien är att de interdisciplinära frågeställningar som är kopplade till tidsresor till det förflutna gör ämnet högst lämpligt för teologisk begrundan.

Tankeexperiment kring ämnet kan ge värdefulla insikter om hur vi hanterar våra liv, vår värld, tiden och Gud idag.

Nyckelord: tidsresor, vetenskap, fysik, teologi, relativitetsteori, logiska paradoxer, tankeexperiment, kontrafaktiskt tänkande, post hoc bön, mening, medskapande, ansvar, minne, relation, processteologi.

Table of Contents

1	Introduction	4
1.1	Aim and research questions	4
1.2	Methods and material	5
1.3	The current research situation.....	8
1.4	Disposition.....	9
2	Research in physics on backward time travel	10
2.1	Approaching the subject	10
2.2	The possibility of backward time travel	11
2.3	Reactions and alternatives	14
2.4	Emerging interdisciplinary topics.....	17
3	Counterfactual thinking and acting	17
3.1	The use of counterfactual thinking	17
3.2	From counterfactual thinking to acting	18
4	Theology and backward time travel	20
4.1	Science and theology	20
4.2	Theological thoughts on time travel to the past.....	20
5	Discussion	22
5.1	Taking science (too) seriously	22
5.2	Backward time travel and God	23
5.3	Creation and responsibility	25
5.4	Meaning	27
5.5	Saving the past?	30
6	Summary	31
7	Further study	32
8	References	34

1 Introduction

This study concerns time travel to the past. The thought of time travel has fascinated man for many centuries. Today, many popular books, TV-series and films have time travel as one of the ingredients. The idea of time travel makes us wonder what *we* would do if we could go back in time. But should we leave backward time travel in the realm of fantasy and fable, or is it worth investigating further? Physicists and philosophers indeed take an interest in the subject, but studying backward time travel has often been, and still is, met by suspicion and ridicule from within these disciplines¹ as well as from other disciplines such as theology. Why is this? In what way is backward time travel different from other unsolved mysteries that puzzle and fascinate mankind?

This study examines the more recent research on backward time travel, exploring the potential for further study in theology. It may also give an explanation of our fascination for the subject.

1.1 *Aim and research questions*

The aim of this study is to explore the relevance of theological study of backward time travel.

This aim is reached in several steps. The current research on backward time travel within physics is examined, as well as reactions and insights from other disciplines. This reveals interdisciplinary questions or topics of possible interest to theology. The current opinion of theology on backward time travel is also examined. All findings are then discussed and the relevance of theological study of backward time travel is evaluated.

Although this thesis is inductive and explorative, my underlying hypothesis is that the topic of backward time travel is inherently interdisciplinary, and that it should therefore reveal questions or topics of interest to other disciplines, including theology.

¹ See e.g., Kip Thorne, who was initially regarded as crazy or senile for conducting time travel thought experiments; Thorne (1995) p 504, 508.

1.2 *Methods and material*

Methodological approach

This study spans over scientific as well as humanistic disciplines and aims to take both of them seriously. It is then appropriate to employ the type of hermeneutics advanced by Ricoeur, a hermeneutics which oscillates between explanation and understanding by using the methods of both natural and human sciences.² Striving to continuously advance the preunderstanding, hidden aspects of reality are revealed, but the aim is never to reach complete correspondence between subjective thinking and objective reality.³

Ontologically, the study relates to two possible realities: the reality that I experience and observe and a reality where time travel to the past is possible. Critical realism includes the possible use of thought experiments⁴ and is in that aspect useful for the study, where I use and expand the method of counterfactual thinking (explained in a later chapter) in order to reveal interdisciplinary issues. Critical realism also claims that reality is not limited to what we can observe, that there is a difference between reality as such and our perception of it.⁵ This may seem appropriate for a study on backward time travel, but if the underlying reality includes the possibility of time travel to the past we do not know and may never know, and the notion of an underlying reality is in itself questioned.⁶ Postmodern thought thus becomes useful in that it questions truth claims and authorities.

Epistemologically, this study is an inductive and explorative literature study in which I aim to discover and understand the subject as well as explore from different angles how it may be relevant for expanded research.⁷ By doing this, the study also has constructive elements. Approaching the subject from different angles and with different methods, exposing the weaknesses of different interpretations and exploring possibilities of breaking out of existing frames of reference illustrates an aim for reflexivity in this study.⁸

The study is written in English rather than in my mother tongue, Swedish. Whereas this has made the process somewhat more difficult, it has also been an experience on the border between the known and the unknown, suitable for the subject of this study. Using a foreign

² Mats Alvesson & Kaj Sköldbberg (2008) p 194.

³ Alvesson & Sköldbberg (2008) p 200. Alvesson and Sköldbberg refer to this understanding as *acetic* hermeneutics.

⁴ Alvesson & Sköldbberg (2008) p 112.

⁵ Alvesson & Sköldbberg (2008) p 108.

⁶ Alvesson & Sköldbberg (2008) p 114.

⁷ Bo Davidson & Runa Patel (2003) p 12-13.

⁸ Alvesson & Sköldbberg (2008) p 488.

language means not only using another vocabulary but another way of reasoning and presenting ideas. Maud Eriksen, a Norwegian theologian living in Sweden, is of the same opinion, and also adds that in another way, “Lutheran” is to be seen as her mother tongue, whereas other “theological” languages are also possible to learn, and learn from.⁹ The same applies to this study, where scientific and theological languages meet.

The research process

This study departs from physics. This choice is based on a personal interest for the discoveries of physics, which I share with several theologians in this study. I also believe that big challenges are found at the borderlines between disciplines. My presuppositions regarding backward time travel were that the laws of physics would possibly allow it, and that research on backward time travel in physics would in one way or other reveal questions and problems of possible interest, but also potentially problematic, to other disciplines such as theology.

The initial text studies relating to the physical aspects of backward time travel revealed several interdisciplinary topics of interest such as determinism, free will, and meaning. These topics in turn gave rise to thoughts on ethics, responsibility and creation. The principle of counterfactualism, applied to backward time travel, confirmed these topics and their potential relevance for theology.

Backward time travel was then related to works of theologians who have shown an interest in physics as well as in the subject of time. Finally, the relevance of theological study of backward time travel was evaluated in a discussion on related theological areas and the interdisciplinary topics.

Alternative methods

It would be possible to perform a hermeneutic study departing from narrative, similar to the way that Antje Jackelén (2005) departs from the study of hymns to finally arrive at the formulation of an eschatological theology. I believe that the resulting interdisciplinary topics would be similar, but the analysis would not necessarily relate theology to science and could thereby lose important aspects. Yet other starting points could be general discussions about time, history, psychology etc. However, from the initial overview of material for this study, which included such work, I again find that this would not reveal all aspects in a satisfactory

⁹ Maud Eriksen (2007) p 40.

way. This does not imply that such studies would not be valuable continuations of this present study.

Material

The base for the present study consists of works by three well known scientists directly engaged in the research on backward time travel: Stephen Hawking (1988), Kip Thorne (1995), and Richard Gott (2005). These works are supplemented with a number of journal articles by philosophers responding to the physicists' results. Also useful is the work of Paul J. Nahin (1999), which discusses time travel using time travel science fiction stories as the point of departure.

When proceeding to explore the interdisciplinary topics, journal articles on counterfactual thinking are supplemented by the reflections of thinkers such as Mircea Eliade (2002), Viktor Frankl (1990, 2003), and Eva Hoffman (2009). When exploring the relevance for backward time travel study in theology, I begin with the works by Swedish bishop Antje Jackelén (2005, 2006, and 2008), physicist and process theologian Ian Barbour (1998), and process theologian David Griffin (1986). These theologians are chosen for their explicit interest in natural sciences and the question of time. Other works by theologians and philosophers are later used in order to evaluate the interdisciplinary aspects of backward time travel, e.g., Sallie McFague (2001) and Peder Thalen (2007).

Throughout, the work on interpretation and reflection by Mats Alvesson and Kaj Sköldböck (2008) has been useful not only to understand and develop the interdisciplinary possibilities of backward time travel but also to understand my own thought process.

The material has been found via library databases, article databases (MUSE, Science Direct and others), internet search engines (mainly Google Books and Google Scholar), internet book shops, book reviews in newspapers and internet book shops, and finally my own previous studies of religion, physics and eco-philosophy.

Limitations

One important limitation regarding this study concerns the very term "time travel". What is included in this term? In one sense, we are all travelling through time, from birth to death. In addition, we may feel that we are visiting the past in our memories or dreams, or that we can see the future in visions. The scope of this thesis, however, is backward time travel where you literally go to the past, following a conscious decision to do so. The focus on backward time travel is due to the fact that this type is the most controversial, giving rise especially to

questions regarding changing the past.¹⁰ Backward time travel for pure study purposes is only briefly treated, mainly when discussing the implications for individual and collective memory.

Only western, Judeo-Christian notions of time are considered. This is done partly to narrow the scope and partly because the interdisciplinary interest for the latest physics is most pronounced in our Western world.

The description and reasoning on physics is on a general level, thereby inevitably oversimplifying certain characteristics of theories, methods, and devices. This is done with the purpose of higher comprehensibility to readers not familiar with the latest physics, in order to enable an understanding of the tentative and complex nature of the research.

1.3 The current research situation

This chapter gives a brief overview of the ongoing research on backward time travel. It will be further explored in chapter 2.

The current research on backward time travel originates in physics. Among the most well-known physicists researching time travel today are astrophysicist Richard Gott, cosmologist Stephen Hawking, and theoretical physicist Kip Thorne. Their research, based on relativity theory, quantum theory or both, aims to provide new insights not only (or not even mainly) about backward time travel as such but about how our universe functions and originated.¹¹

Given the difficulties of “real”, concrete experiments in time travel research, these experiments are to a very high extent replaced by thought experiments where physical laws are pushed to their limits, in order to see what they can permit and what they must always forbid.¹² In this, the research adheres to the theory of critical realism rather than to classical positivist thinking. When it is impossible to study a phenomenon by real experiments, critical realism favors thought experiments and the study of extreme cases.¹³

¹⁰ Time travel to the future, on the other hand, is not very controversial. I will not expand on it here, but anyone interested could look up what is often referred to as the “twin paradox” where a twin traveling fast and far away in space and eventually returns to earth, will find that the twin remaining on earth has aged much more. The space traveling twin has thus traveled into the future. See Gott (2005) p 33 ff; Perszyk & Smith (2001) p 2ff.

¹¹ See e.g., Richard J. Gott (2005) p xii.

¹² Kip S. Thorne (1995) p 492-493.

¹³ Alvesson & Sköldbberg (2008) p 112.

The research on backward time travel results in a number of possibilities presented by various scientists, where no one can claim to possess the truth. In this, the research falls under the postmodern questioning of truth claims. This is not to say that “anything goes”. In line with Toulmin’s discussion on domains,¹⁴ research on backward time travel chooses a foundation, be it relativity or quantum theory, which forms the bridgehead [Swe: “brohuvud”] in a domain, and whose applicability is then expanded within this domain, e.g., by the theories of Gott or Thorne.

The results of backward time travel research in physics are often of interest to philosophers. These, however, focus not on the physical aspects of time travel but on the consequences of the thought experiments on time travels, such as logical paradoxes.

1.4 Disposition

After this introductory chapter, chapter 2 deals with the actual research of backward time travel in physics and its results, as well as reactions to these results and proposed alternatives. Chapter 3 introduces the notion of counterfactual thinking, which is then used to examine interdisciplinary topics related to backward time travel. The standpoint of theology on the subject of backward time travel is discussed in chapter 4. Chapter 5 is a discussion of the findings of the study and how they relate to theology, and is followed by a summary of the study in chapter 6. The study ends with suggestions for further study in chapter 7.

¹⁴ See Alvesson & Sköldberg (2008) p 43-44.

2 Research in physics on backward time travel

2.1 Approaching the subject

Despite the fact that most publications on all types of time travel are found in the discipline of physics, many of these publications touch on more existential or religious aspects, often in the introductory chapter and seemingly to catch the reader's interest. Richard Gott's book begins with asking the question "What would you do with a time machine?",¹⁵ and Paul Nahin exclaims "To travel in time. Could there possibly be a more exciting, more romantic, more wonderful adventure than that?"¹⁶ So what do these authors imagine doing with a time machine? Gott's suggestions include going to the past and rescue a lost loved one, or killing Hitler.¹⁷ The time machine could also be of use to criminals, who could go to the past to hide from their pursuers, or murder their enemies when they are still children.¹⁸ Gott stops for a moment to wonder if time travel would really let you change the past, but then concludes that even if this turns out to be impossible, you could still go back and participate in historic events such as Jesus' Sermon on the Mount.¹⁹

Apart from personal reflections, most physicists writing on the topic of backward time travel refer to the inspiration they have found in science fiction.²⁰ Several conceptual issues presented in fiction are today taken seriously by philosophers as well as scientists.²¹ Nahin argues that time travel stories make us *think*, by turning our everyday world view upside down and inside out.²²

The more direct usefulness of science fiction for time travel study is shown in the example of Kip Thorne. When helping his friend, astrophysicist and writer Carl Sagan, to work out the scientific details of a novel dealing with going from one part of the universe to another, Thorne came up with the idea of using wormholes. While developing this thought, he found himself studying time travel.²³

¹⁵ Gott (2005) p 3.

¹⁶ Paul J. Nahin (1999) p 1.

¹⁷ Gott (2005) p 3-4.

¹⁸ Nahin (1999) p 32.

¹⁹ Gott (2005) p 4.

²⁰ Nahin (1999) p ix, foreword by Kip Thorne; Gott (2005) p 5.

²¹ Nahin (1999) p xx.

²² Nahin (1999) p 5.

²³ Thorne (1995) p 483ff.

2.2 The possibility of backward time travel

The basis for most research and theories on backward time travel is Einstein's theory of relativity. While classical physics considered time as something universally absolute, common to everything and every place in the universe, relativity teaches us that different *frames of reference* have their own notion and measure of time.²⁴ Whereas time is relative, the speed of light instead turns out to be absolute and not depending on the frame of reference. In addition to this, nothing can move faster than light.²⁵

The relativity of time is problematic, but can be solved by treating time, mathematically, as if it were a fourth dimension of space, thus weaving space and time together into a *spacetime*. Robert March points out that the words *as if* are crucial – it has never been implied that space and time have lost their separate identities.²⁶ Using the spacetime concept, we can describe events that take place in particular places at particular times. Your own life is a good example: living your life, you will move around not only in the three dimensions of space but also in time, growing older all the time - you are moving in spacetime. When you finally die, your journey in spacetime ends. Your complete journey in spacetime is called a *world line*²⁷ and can be plotted in a spacetime diagram, with space dimensions on one or more horizontal axes and time on the vertical axis.

Light has its own world line as a result of spreading out in space with constant speed. In a spacetime diagram, the limits for your own world line are those formed by the world line of spreading light. This world line for light has the shape of a cone opening upwards like the upper part of an hour glass, and is called *the future light cone*.²⁸ Your own world line (or the world line of any other object) can never stray outside this light cone, since this would mean traveling faster than light. This also means that an event can never affect another event which is outside the first event's future light cone. There is a corresponding *past light cone* (shaped like the lower part of the hour glass) containing all the earlier events that could possibly have affected you here and now.²⁹

²⁴ See Hawking (1988) p 33. An example: Driving in your car down on earth is one frame of reference, whereas a gps satellite orbiting high above the earth is another. The relativity of time results in your clock not ticking in synch with the clock in the gps satellite. If corrections were not made for this difference, your gps would soon lead you noticeably astray! (Kjell Prytz, lecture in Physics for Humanists, Högskolan i Gävle, May 2010).

²⁵ Absolutely nothing – not information of any kind, not your thoughts, nothing!

²⁶ Robert March (2003) p 117, 118.

²⁷ Nahin (1999) p 56, 85.

²⁸ For pictures of light cones, see e.g., Hawking (1988) p 26-27.

²⁹ Hawking (1988) p 25, 28. An example: If the sun should suddenly die now, the information about this event would start spreading in a future light cone. On earth, you would be unaware of what happened for eight minutes (the time it takes to reach the earth from the sun) since you are still outside of the light cone. Then, the light cone

Light cones and the relativity of time are important for the research on backward time travel. If you go back in time, your world line will form a loop, and in a spacetime diagram this will be seen as your world line leaving your future light cone. This can only happen if you travel faster than light, which is impossible.³⁰ The problem can be overcome, but all proposed backward time travel solutions must somehow get around the limitations imposed by the speed of light. As we will see later, backward time travel also gives rise to logical problems that need to be overcome.

Beating the beam of light

According to the general theory of relativity, spacetime can be *curved*, or warped, by mass and energy.³¹ If you could somehow take a shortcut through this curved space, you could arrive at a certain place faster than a light beam travelling the longer way through space, and going somewhere faster than light means that you can travel to the past.³² There are several types of shortcuts, all permitted by the relativity theory. However, some of them are not possible in a universe like ours. One example is the solution proposed by mathematician Kurt Gödel. He described an infinite, rotating and static (neither expanding nor contracting) universe which allowed shortcuts and time travel to the past.³³ Now, our universe is neither rotating, nor static, so Gödel's model does not work here. To Gott and others, the solution still shows that backward time travel is possible *in principle*, and that there may be other solutions to Einstein's theories that *do* allow such time travel in our universe.³⁴

Another form of shortcut is the wormhole, a sort of tunnel connecting one part (and time) of the universe with another.³⁵ Wormholes could possibly be created naturally in black holes, which make them interesting for many time travel researchers. It is normally presumed that going into a black hole will crush you.³⁶ But if the black hole is *rotating*, there could be a wormhole inside, allowing an astronaut to fall through before being crushed, ending up in another region of the universe and even into the past or the future.³⁷ One disadvantage is that

reaches you and you find that the sun has died. The future light cone of the sun dying is now a part of your own past light cone, i.e., it is something that can, and has indeed, affected you!

³⁰ Gott (2005) p 59.

³¹ This is sometimes illustrated with a heavy ball pressing down a blanket held in each corner by four people.

³² Gott (2005) p 83.

³³ Gott (2005) p 90-92; Nahin (1999) p 19, 81.

³⁴ Gott (2005) p 92.

³⁵ Gott (2005) p 83-85, Thorne (1995) p 483 ff.

³⁶ Hawking (1988) p 88; Thorne (1995) p 450-453, 459.

³⁷ Nahin (1999) p 89.

the black hole wormhole is one way only. Thorne also discusses ways of constructing wormholes if there are no natural ones. The methods of creating wormholes include using quantum methods to tear holes in space, or using classical physics to twist spacetime. There is even a proposed solution where time travel is used during the construction of the wormhole, carrying things from the later stages of construction back to the earlier.³⁸ Even if you managed to construct a wormhole, it would be nearly impossible to keep it open long enough for anything to pass through it. Even the slightest disturbance, such as the presence of the astronaut, could destroy the wormhole before it could turn into a time machine.³⁹ A solution proposed by Thorne involves lining the walls of the wormhole with so called *exotic material* which would push the walls outwards. Stephen Hawking has later found that the vacuum fluctuations near the so called event horizon of a black hole are exotic.⁴⁰

For the above described time machines, and for all time machines working in accordance with general relativity, there is one important restriction: you could never go to an earlier time than when the time machine was created, because if you did, that would mean leaving your future light cone and traveling faster than light.⁴¹ One obvious reason why we have not met any time travelers from the future would then be that there are no functioning time machines yet. Other explanations to the absent time travelers are that they are melting in too well or that nobody would believe anyone claiming to be a time traveler. It could also be that time travel is forbidden in the future due to the dangerous consequences, or, the most pessimistic explanation: there are no humans left in the future to do any time traveling to the past.⁴²

Is relativity enough?

Although relativity sets many of the restrictions for backward time travel, quantum theory also influences the research, and so will the yet incomplete theory of quantum gravity, combining relativity and quantum physics. Such a theory could, among other things, allow a spacetime which is curved all around, bending round onto itself. There would be no boundaries and if you moved in one direction you would finally end up in the time and place where you started.⁴³

³⁸ Thorne (1995) p 493-497.

³⁹ Thorne (1995) p 486, 516-519.

⁴⁰ Thorne (1995) p 488-491.

⁴¹ See Gott (2005) p 109; Thorne (1995) p 504; Ken Perszyk & Nicholas J.J Smith (2001) p 9; Nahin (1999) p 412, note 4.

⁴² See Nahin (1999) p 67-68, 70-72; Perszyk & Smith (2001) p 9.

⁴³ Nahin (1999) p 547; Gott (2005) p 85; Hawking (1988) p 44.

Physicists are also inspired by the subatomic superstring theory, but on a cosmic level. Proposed solutions include infinitely long cylinders or strings, rotating or attracting each other in ways that would allow shortcuts and backward time travel if travelling around them in certain ways.⁴⁴

2.3 Reactions and alternatives

The proposed ways of backward time traveling above are far more complicated than the ways proposed by fantasy and fiction. But the objections to backward time travel rarely concern the difficulties of bending space or finding and using cosmic strings. Instead, philosophers and scientists argue against backward time travel by showing that it entails unacceptable or even absurd consequences.⁴⁵ Below, some objections and alternative solutions are presented.

Protection mechanisms

It has been suggested that the difficulty of holding open a wormhole (see above) could be part of a bigger mechanism, a Chronology Protection Mechanism, which prevents all time travel to the past. To some, this would be a disappointment, or at least something that we cannot know anything about until we become experts on the laws of the still incomplete quantum gravity theory.⁴⁶ Others are so certain about the existence of a protection mechanism that they want it to be taken as an axiom even if it is not yet discovered.⁴⁷ Stephen Hawking hopes that some kind of censorship hypothesis holds, since time travel to the past could otherwise be possible. He states that “while this would be fine for writers of science fiction, it would mean that no one’s life would ever be safe: someone might go into the past and kill your father or mother before you were conceived!”⁴⁸

Can the past be changed?

Stephen Hawking is not alone in fearing the consequences of changing the past. The example of someone going back in time to kill his father, or more often grandfather, is known as *the grandfather paradox*: If you go back in time and kill your grandfather, you will never be born. Then you will never grow up and decide to go back in time to kill your grandfather. So then

⁴⁴ Gott (2005) p 92-109.

⁴⁵ Holger Lyre (2008) p 4.

⁴⁶ Thorne (1995) p 521.

⁴⁷ See Nahin (1999) p 91.

⁴⁸ Hawking (1988) p 89.

he *will* actually live, and you will be born after all. Since nothing can prevent such paradoxes to occur, it is concluded that all time travel to the past is impossible.⁴⁹

The strange situations that could occur through backward time travel are mind-provoking, but are they enough to prove that time travel to the past is impossible? Gott finds that the paradoxes associated with time travel pose a challenge and often provide clues that “some interesting physics is waiting to be discovered”.⁵⁰ In a similar way, Nahin wonders if the paradoxes only *seem* paradoxical due to our restricted knowledge.⁵¹ He finds that physicists have classed phenomena as “unphysical” many times in the past, only to later find that they are in fact supported by good evidence.⁵²

Some hold that even if you cannot *change* the past, due to paradoxes etc., nothing prevents a time traveler from *affecting* the past. Whatever any time traveler has ever done when visiting the past is now a part of the history we know. What once happened is what happened, and there are no “second chances” to alter earlier events.⁵³ This is called the *self-consistency* principle, and is supported by physicists and philosophers like Thorne, Goddu, Nahin, and Gott.⁵⁴ This means that you cannot and will not go back in time and kill your grandfather, since you are alive today to prove otherwise.⁵⁵ But if you cannot go back in time and kill your grandfather, then how free are you? The self-consistency principle leads to questions concerning determinism and free will.⁵⁶

To solve the free will problem and allow changes to the past, a number of solutions have been presented. One often mentioned solution is the many-worlds or *multiverse* theory, inspired by quantum theory, where every event - big or small - that you change in the past will create a new, parallel universe. The time traveler will be transferred to this new universe and will have to stay there forever with no way of going back, whereas the original universe is left

⁴⁹ Another “impossible” paradox is the *causal loop*, where an event is caused by a later event that, in turn, is caused by the earlier event: You could be given a clock by a time traveler, who then leaves. In your old age, you encounter the time traveler and give the clock back to him. He then goes back in time to give the clock to you. The paradox consists of the fact that the clock is never manufactured; see Gott (2005) p 23. The mystery gets even bigger if you, in your old age, decide *not* to give the clock back to the time traveler after all. This interruption of a causal loop is called a *bilking paradox*, or *ontological paradox*; see Nahin (1999) p 546.

⁵⁰ Gott (2005) p 29.

⁵¹ Nahin (1999) p 250 quotes physicists wondering the same thing.

⁵² Nahin (1999) p 92.

⁵³ Perszyk & Smith (2001) p 7-9; Gott (2005) p 16-17; Nahin (1999) p 269 ff.

⁵⁴ See e.g., Gott (2005) p 19-20; G.C. Goddu (2003).

⁵⁵ The self-consistency principle also prevents historic events from being crowded with more and more time tourists. All possible time travelers to any past event are part of the crowd that was originally there; see Nahin (1999) p 280.

⁵⁶ Nahin (1999) p 49; Gott (2005) p 17.

unchanged. There could then be one universe where you actually succeed in killing your grandfather and one where you do not.⁵⁷

Another solution, presented by G.C. Goddu, can be likened to rewinding and then recording new material on a previously recorded VCR tape.⁵⁸ In the case of time travel, you would live your life up until a certain time, then go back in time (“rewind”), and change the past (“re-record”). As with the multiverse solution, the time traveler would always remain in the changed universe, but this time for the reason that there is no longer any original future to return to – it has been overwritten and the new universe is all there is.⁵⁹ After the time travel, history books will tell only about the world changed by the time traveler, not the world before.⁶⁰

Rather than trying to solve the free-will problem, Gott asks us to consider this: “Free will never did allow one to do something logically impossible. I might wish right now to instantly become a tomato larger than the whole universe, but no matter how hard I try, I cannot do it.

Killing your grandmother may be a similarly impossible task”.⁶¹

Free will may even be an irrelevant concept. In a four-dimensional view of space and time, other times are treated like other places: they are equally real as the present, but just *somewhen* else in the same way that other places are *somewhere* else.⁶² If the past, present, and future are equally real, this means that every event is fixed in spacetime. There is no change, everything just is. This is referred to as the *block universe*. Nahin claims that if there is no such thing as change, the whole concept of free will falls like an illusion.⁶³

⁵⁷ Gott (2005) p 13-15. John Abbruzzese (2001) claims that the multiverse theory is not about time travel at all, but universe travel. If you go “back” to the year 1001, you actually travel across to a similar but *present* (not past) year 1001 in another universe. There you may act and influence the future just like anyone else.

⁵⁸ Goddu (2003) p 20ff, here described without explanation of underlying reasoning on hypertime and normal-time etc.

⁵⁹ The difference between time travel and VCR re-recording is that the various parts of the VCR cassette are not causally related to each other, whereas in real life, events obviously are; see Goddu (2003) p 23.

⁶⁰ Goddu (2003) p 24-25.

⁶¹ Gott (2005) p 17.

⁶² Perszyk & Smith (2001) conclude that “Our ancestors and descendants exist just as much as we do and in the same full-blooded sense. They’re just at a temporal distance from us”; see p 4.

⁶³ Nahin (1999) p 155.

2.4 Emerging interdisciplinary topics

In this chapter, we have seen a number of questions arise which are certainly of interest to certain physicists but which cannot be handled within physics. Free will and determinism are most discussed today. Emerging not from physics but from the physicists' discussions on narrative and the possible use for backward time travel are questions regarding ethics and responsibility. Furthermore, the discussion on the block universe relates to change and creation, whereas the "VCR" solution implies consequences for memory and identity.

As we have seen above, the research on backward time travel often begins with asking "what if...?" The study of backward time travel in fact involves "what if?" questions on several levels. First: what if physical laws and logic allow time travel to the past? Second: what if man could go to the past? And third: what if man could change or affect the past?

The first level is, consciously or not, the base for all scientific work now and in the past: what if man could fly, what if we could communicate over long distances etc. The second level is a more practical extension of the first: how would you actually do it? The last level, about changing or affecting the past, is at a first glance very similar to what is called counterfactual thinking, and this merits further investigation.

3 Counterfactual thinking and acting

3.1 The use of counterfactual thinking

Counterfactual thinking is something we all do in our daily life; it simply means pondering on how certain events could have turned out differently. Counterfactual thinking can also be more deliberately and scientifically used in order to investigate the presumed inevitability of certain events, to understand which events affected the outcome and which did not etc. In this form it has been found especially valuable in history and politics.⁶⁴

Experiments by Kray et al. (2010) on college students show that counterfactual reflection on pivotal events in life, positive as well as negative, promotes meaning. In the latter case, the negative events are generally compared with even worse scenarios than the one that actually occurred, but even when counterfactual thinking causes regret, this can eventually favor

⁶⁴ Simon Kaye (2010) p 39.

happiness and maturity.⁶⁵ The experiments also reveal that actively reflecting on an event *without* using counterfactual thinking, does not give the same sense of meaning; and attempts to *actively* generate meaning will often fail.⁶⁶

If thinking negatively about an event becomes repetitive, only producing better alternatives, this may cause regret and depression. The risk for this is linked to the temporal distance from the event. When the event is still recent in time it may be too emotionally difficult to produce meaning-promoting counterfactuals.⁶⁷

3.2 From counterfactual thinking to acting

Although counterfactual thinking approaches the way we reason about backward time travel, and confirms some of the topics that emerged in the previous chapter, it does not cover all aspects. Counterfactual thinking asks “what if past events had been different?” whereas backward time travel often concerns “what if I could *make* past events different?” This latter version, perhaps one could call it counterfactual acting, is active rather than passive, and raises other questions about responsibility etc. This is briefly illustrated by some examples below. Several topics are further discussed in chapter 5.

Personal gain or altruism

Kahneman and Miller find that the most common type of counterfactual thinking on a personal level is to alter exceptional values and make them normal: “if he had only taken the normal route home he wouldn’t have been hit by the truck”.⁶⁸ While backward time travel could actively attempt to make exceptional events normal, the opposite could also apply.

Would it not be tempting to hand in a Lotto coupon with the numbers known to win?

Simon Kaye (2010) notes that counterfactual thinking is rarely neutral; the alternatives are either better or worse than the actual reality.⁶⁹ If the same applies also for actually changing the past, the risk of making things worse rather than better, even with good intentions, cannot be neglected.

⁶⁵ Kray, et al. (2010) p 107, 111, 113-114.

⁶⁶ Kray, et al. (2010) p 110,114.

⁶⁷ Kray, et al. (2010) p 116.

⁶⁸ D. Kahneman & D.T. Miller (1986) p 143.

⁶⁹ Kaye (2010) p 49.

Individual and community

When studying alternative histories, whether in fiction or science fiction, Kaye notes that they place the control in ordinary individuals rather in the “great men” of earlier times. This can be seen as a great possibility for the individual - anyone can change the course of history!⁷⁰ When we think about changing the past, we indeed normally imagine individuals, often ourselves, doing it. But if humanity was presented with the possibility to change the past, who would be in charge, and would the possible effects on others be considered?

Fate

The experiments by Kray et al. show that counterfactual thinking makes events meaningful by seeming meant to be, thus giving a sense of fate.⁷¹ As the counterfactual experiments also confirm, Viktor Frankl is positive that meaning can be found in any circumstances, even when we face a fate that cannot be altered, when we face suffering.⁷² However, there are desperate situations where all imagined counterfactual worlds seem better than the one actually lived in. In the case of counterfactual thinking, this amplifies despair.⁷³ If it were possible to go back in time and change the past, would it instead provide the only hope?

The human life story

Paul Ricoeur believed that meaning is achieved through our life story, and that this life story is something we have to construct ourselves.⁷⁴ One result from the counterfactual experiments mentioned above is that counterfactual alternatives to the events that actually happened are normally rejected since they “do not fit” with the actually lived life story.⁷⁵ Going back in time and changing the past means re-writing one’s life story, possibly many times. Will the plot still be discernible?

⁷⁰ Kaye (2010) p 45.

⁷¹ Kray, et al. (2010) p 109-110.

⁷² Viktor Frankl (2003) p 82, 85.

⁷³ Kray, et al. (2010) p 116, footnote 6.

⁷⁴ See Mark I. Wallace (1995) p 13 for a short summary of the reasoning.

⁷⁵ Kray, et al. (2010) p 110, 115.

4 Theology and backward time travel

4.1 Science and theology

Theologians today, especially when inspired by process theology, often take great interest in the latest discoveries of other disciplines, not least physics. Swedish bishop Antje Jackelén finds that it is at the borderlines and boundaries that creativity happens and inspires improvement, enhancement and perfection.⁷⁶ Still, it is not uncommon to encounter theologians as well as scientists who fear any contact between their disciplines. Jackelén relates this fear to insecurity about where the boundaries are located, and fear of transgressing them.⁷⁷ Showing no such insecurity in her own work on formulating a relativistic eschatology, Jackelén explicitly intends to “take seriously the best knowledge we have about the natural world in its past, present and future states and that with equal seriousness applies the best theological knowledge we have available”.⁷⁸ In another work on time and eternity, she states that “[u]sing cosmological theories, I will concentrate especially on the boundaries of time”.⁷⁹ Jackelén holds that modern physics has forced us to rethink apparently simple concepts such as space, place, time, and velocity, and that we have “grasped that the world is not *really* the way that everyday concepts would lead us to believe”.⁸⁰ However, in spite of this great respect for natural science, Jackelén warns us that neither science nor theology knows everything about time.⁸¹ Physicist and process theologian Ian Barbour also denies absolute and eternal knowledge about the world, in holding that search for unity and coherence must always be tentative, explorative, and open.⁸²

Considering the theological interest in physics as well as in boundary issues, and assuming that backward time travel is such a boundary issue, does theology take an interest in the subject? If so, how is it treated?

4.2 Theological thoughts on time travel to the past

Barbour finds it striking that general relativity permits a finite, curved and closed universe, where a person setting out from the earth in one direction will finally end up where he

⁷⁶ Jackelén (2008) p 52.

⁷⁷ Jackelén (2005) p 7.

⁷⁸ Jackelén (2006) p 970.

⁷⁹ Jackelén (2005) p 125.

⁸⁰ Jackelén (2005) p 157.

⁸¹ Jackelén (2005) p 181.

⁸² Barbour (1998) p 325.

started.⁸³ That this kind of universe could possibly also allow a traveler to end up *when* he started is not discussed. Barbour in fact explicitly rejects the idea of backward time travel, based on the impossibility of effects preceding their causes, and he concludes that there is no way to influence the past or to change history.⁸⁴

Jackelén's study on time and eternity (2005) also addresses many topics of physics which are common with the research on backward time travel. Jackelén is familiar with the significance of light cones and the four-dimensional spacetime.⁸⁵ She also mentions the protection mechanism against time travel to the past, but does not express her own opinion about it.⁸⁶ Furthermore, Jackelén takes great interest in quantum theories, and briefly mentions the multiverse theory but dismisses this idea as being speculative.⁸⁷

Process theologian David Ray Griffin (1986) finds the idea of going back in time and revise the past to be metaphysical speculation resulting from certain popular interpretations of physics⁸⁸ He is certain that commonsense, based on our experience, will keep the great masses from believing such interpretations. According to this commonsense, we can affect only the future, not the past. Griffin finds it of great importance that philosophy does not ignore such commonsense notions.

⁸³ Barbour (1998) p 179.

⁸⁴ Barbour (1998) p 178. In fact, effects do not precede their causes, since each object follows its own world line in a forward direction, even when this world line somehow manages to end up in the past.

⁸⁵ Jackelén (2005) p 142, 147.

⁸⁶ Jackelén (2005) p 161.

⁸⁷ Jackelén (2005) p 155; p 300, footnote 315.

⁸⁸ By authors like Fritjof Capra (*The Tao of Physics*), Gary Zukav (*The Dancing Wu Li Masters*), and Fred Alan Wolf (*Taking the Quantum Leap* and other titles).

5 Discussion

5.1 Taking science (too) seriously

Today, we find ourselves in a time where science as well as religion is questioned, and neither discipline is expected to provide any big and eternal Truths. Even so, it is widely claimed that theologians need knowledge on the latest findings in natural science, since this is a part of our daily life and affects how we think.⁸⁹ Some even demand that the results of other disciplines be compatible with those of natural science.⁹⁰ However, the founder of process philosophy, Alfred North Whitehead, warned of “the fallacy of misplaced concreteness”, i.e., taking scientific concepts as an exhaustive description of the real world.⁹¹ The research on backward time travel is conducted mainly by means of thought experiments, which cannot pretend to describe an underlying reality by means of verifiable experiments. These thought experiments clearly illustrate the fact that scientific theories in general and theories regarding backward time travel in particular, are intellectual constructions. Such constructions do not provide a world view to “believe” or “not believe” in, but can only prove more or less useful on the basis of observations.⁹²

Neither physicists nor philosophers find it necessary to actually believe in backward time travel in order to be inspired by it or conduct research on it.⁹³ For theology, however, the problem seems to be exactly that scientific theories on the subject are turned into something to believe or not believe in. Griffin (1986) states that “[i]n our culture, it has become very difficult to believe something wholeheartedly if physical theory seems to contradict it”. In the case of backward time travel, the theologians mentioned in this study choose to reject the idea although physical theory does *not* contradict it. By making the idea of backward time travel a question of belief and choosing not to believe in it, theology also remains ignorant of the related interdisciplinary subjects as sources of inspiration.

I here find it of value to consider the trilateral truth concept, consisting of correspondence, usability, and meaning.⁹⁴ As we have seen, the research on backward time travel does not provide truth in the form of correspondence with reality. Moving on to usability, it is often

⁸⁹ See e.g., Taede Smedes (2008) p 241.

⁹⁰ Carvalho (2008) p 220, 223.

⁹¹ Barbour (1998) p 292. Compare Jackelén and Barbour above, chapter 4.1.

⁹² Hawking (1988) p 139; Jackelén (2005) p 140.

⁹³ See e.g., Thorne (1995) p 516.

⁹⁴ See Alvesson & Sköldberg (2008) p 48, 51.

claimed that the use of science lies in its practical applications,⁹⁵ but physicists today can hardly even imagine the technology needed for backward time travel. What this study *does* show, is that the research on backward time travel may clearly relate to meaning: what would backward time travel mean for man and for society?

The negative reactions to backward time travel can be contrasted with the inspiration that theology finds in quantum theory. The quantum theory discussions on probabilities and possibilities are frequently incorporated in theological reasoning on eschatology, emergence etc. An absolute belief in the existence of subatomic particles does not seem necessary for statements like the following by Jackelén: “Quantum physics tells us that we can never have complete information and thus can never have complete control over the reality in which we participate [...]”⁹⁶ Barbour, also inspired by quantum theory, favors a God who presents possibilities, who influences events without controlling them.⁹⁷

5.2 Backward time travel and God

Theology today does not discuss the notion of God in relation to backward time travel, but this does not mean that such discussion is not possible. Certain aspects have been discussed in the past, and others still are, even if no longer by theologians. One such aspect is the question whether or not God can change the past. Judeo-Christian faith assumes that for God, everything is possible.⁹⁸ This should include the possibility of God changing the past, but theologians as early as St. Thomas Aquinas have argued that God cannot change the past, since this is a logical contradiction.⁹⁹ Today, non-theologians focus on other aspects of God’s omnipotence in connection with backward time travel. Nahin wonders how God can overlook all times and events in a block universe,¹⁰⁰ and Q. Smith argues that God cannot be unique and at the same time branch into multiple time tracks, with the conclusion that in all time tracks but one, there may be no God.¹⁰¹ Taede Smedes (2008) holds that any such discussion of a “competition” between God and the natural order ignores God’s transcendence. God is of a different order

⁹⁵ Thalén (2007) p 142, 148.

⁹⁶ Jackelén (2005) p 173. However, it seems to come close to the fallacy of misplaced concreteness, see above.

⁹⁷ Barbour (1998) p 239-240.

⁹⁸ Eliade (2002) p 156-157.

⁹⁹ Thomas Aquinas, *The Summa Theologica*, First Part, Question 25, Article 4.

¹⁰⁰ Nahin (1999) p 162, 248.

¹⁰¹ Smith (1989) p 31.

than the created world and stands above its laws, so the logic concerning the natural order does not apply to the divine.¹⁰²

The God discussed by Aquinas, Nahin, or Smith is often referred to as a “God of philosophy”, a being looking down on us from above and governing our lives. What Smedes shows, is that discussions involving such a God always risk becoming philosophical rather than theological. Contemporary theology, whether referring to itself as postmodern or not, often claims this “God” of philosophy to be obsolete, and instead aims to find the *real* God.¹⁰³ Jackelén argues that theology today should be concerned with a God in the center of the known.¹⁰⁴ In this new theology, relationality becomes essential. A focus on relation must also include the relation to time, and a “God beyond time” is replaced by a God which includes temporality or even, in the view of process theology, a God conceived as a temporal process.¹⁰⁵

Peder Thalén instead requests a new way of talking about God, a way which challenges not our minds (which would make it vulnerable to philosophical attacks) but our way of living.¹⁰⁶ For Jackelén as well as for Thalén, it becomes important to focus on the way we actually live in the world and relate to each other, to God, and to time. It may be a demand to take science less seriously.

Everyday life for Christians includes faith. Mircea Eliade shows how Christianity extended the Jewish assumption that everything is possible for God to include also man. Eliade sees how faith liberates man from every “law” of nature and provides him with the freedom to intervene in the very ontological constitution of the universe.¹⁰⁷ Apart from implying that faith may enable man to go back in time, I hold that this notion of faith questions the commonsense notion that we can affect only the future, and not the past.¹⁰⁸ This becomes clear in the case of post hoc prayer (also called retroactive petitionary prayer). Somewhat similar to counterfactual thinking, and familiar to most of us, two examples of post hoc prayer are praying that a loved one was not on a train that crashed, or that a tumor about to be removed by surgery proves non-malignant.¹⁰⁹ The post hoc prayer seems to be asking for an already passed event to be altered by God, and this is often met by counter-arguments referring to logical impossibilities etc. According to Smedes, theology needs not be concerned with such philosophical arguments. Furthermore, Geoffrey Brown (1985) argues that post hoc prayer is not about altering the past

¹⁰² Smedes (2008) p 246.

¹⁰³ Thalén (2007) p 69; see also Jayne Svenungsson’s work (2004) on the return of God.

¹⁰⁴ Jackelén (2005) p 163-164.

¹⁰⁵ Jackelén (2005) p 82-83.

¹⁰⁶ Thalén (2007) p 31.

¹⁰⁷ Eliade (2002) p 156-157, referring to Mark 11:22-24.

¹⁰⁸ See Griffin above, chapter 4.2.

¹⁰⁹ Geoffrey Brown (1985) p 83-86. See also Nahin (1999) p 275-276. It should be noted that post hoc prayer has been discussed even earlier by C.S. Lewis in his book *Miracles* from 1947.

but rather about believing that God was influenced by our later prayers when acting at the original event. The reasoning is similar to the self-consistency principle discussed earlier: what once happened cannot be altered, but it is possible to *influence* what happened. In the case of post hoc prayer, we try to influence the past not by going back in time ourselves, but by attempting to influence God's actions.¹¹⁰

Apart from approaching the subject of backward time travel and showing man's complex view of time and God's abilities, the post hoc prayer stresses the importance of the relations between God, man, and time in everyday life, while not completely abandoning the "God of philosophy".

I find that the discussions on post hoc prayer and faith above indicate a religious interest in questions that approach the subject of backward time travel. This could in itself motivate further theological study of the subject, but the relevance becomes even stronger when considering the current shift of focus from an omnipotent, distant God to a God in the center of the known. The interdisciplinary topics related to backward time travel highlight important questions and aspects of everyday life in this world that we know and live in. This will be further discussed below.

5.3 Creation and responsibility

Process theology talks about human participation in God's ongoing creation.¹¹¹ Apart from the block universe solution to backward time travel, where no creation or co-creation is possible, the question of creation in connection to backward time travel could be a relevant area of study for theology. Jackelén sees how we humans have a responsibility for shaping our lives and the future in a time where there is a question whether the future is possible at all. To Jackelén it is clear that we need hope - not for an eternity, but for a future for the all the creatures on earth.¹¹² Eco-feminist and theologian Sallie McFague agrees that the most important task for humanity lies in loving the world, by helping all creatures to flourish. To McFague, loving the world is to love God, whereas "believing in God" is not important since God is no object or being.¹¹³ Thalén suggests that we talk about God's action in our daily life,

¹¹⁰ In fact, I assume that even atheists would strongly wish for a happy outcome of the train accident etc., even if not directing a prayer to God. It would be interesting to investigate post hoc wishes not consciously based on faith, and the consequences of such wishes for the whole reasoning on post hoc prayer.

¹¹¹ Barbour (1998) p 214.

¹¹² Jackelén (2005) p 40, 55.

¹¹³ Sallie McFague (2001) p 127-128, 134-135, 137, 151.

and see the individual acting not independently from God but in relation to God, as responsible collaborators in God's manifestation in the world.¹¹⁴ Thalén also points out that in the past, faith was a way of living and no abstract reasoning about the *existence* of God.¹¹⁵

Time travel to the past could mean co-creation, if done with the intention of benefit to others or to the whole world. It is a possibility that man, by adopting McFague's view that everything in the world is individual but dependent on others, will choose to live in a way which will not ruin the foundation for our very existence.¹¹⁶ Any decision to go back in time would then have to be accompanied by this insight. But how would we know what is good for someone else or for the world, both in the short and in the long term?

Backward time travel could also be done from self interest, whether performed and controlled by individuals or by institutions, governments etc. In an earlier example, I discussed the possible temptation to create a winning Lotto coupon. But would winning at Lotto make life better and more meaningful? Many today doubt that consumption and material riches enhances life quality.¹¹⁷

I believe that self interest, in combination with modern man's impression that he has rightfully taken over the power from God to control the world¹¹⁸ could lead to human dominion over time as well as over the whole world. It would mean anthropocentrism of a whole new dimension, possibly or even probably in combination with eurocentrism, ethnocentrism and the like. The dangers appear even greater when considering that scientific research today is dependent of multinational interests, often economical rather than political.¹¹⁹ Jackelén states that "[n]atural scientific discoveries tend to create their own ideologies, and in terms of their consequences, they strongly call for ethical reflection."¹²⁰ But in the case of backward time travel, who would be the dialogue partners in this ethical reflection? The question becomes especially difficult when considering the multiverse and "VCR" solutions. In the multiverse solution, changing one event will create a new universe, where the originally responsible party may not exist or is unaware of the presumed responsibility. With the "VCR" solution, nobody will even know that the past has changed once it is done, and who could then assume responsibility?

¹¹⁴ Thalén (2007) p 65, 75.

¹¹⁵ Thalén (2007) p 18.

¹¹⁶ McFague (2001) p 100-101.

¹¹⁷ See e.g., McFague (2001) p 81 ff.

¹¹⁸ See Thalén (2007) p 114-115.

¹¹⁹ See e.g., Georg Henrik von Wright (2000) p 63.

¹²⁰ Jackelén (2005) p 177.

Co-creation and dominion are both possible interpretations of God's intention with man, but it is difficult to see which one would be actualized in the case of backward time travel. In addition to this, regardless of the intentions, the actual result of time travel to the past would be unclear. In the case of alternate universes, there would be no way of turning back to the original universe if things do not turn out the way the time traveler expected.

Backward time travel, then, is no predictable affair. But would it stop us? For the younger generations of today, the idea of changing the past may be very tempting. In a majority of action games for PC or game consoles, your chosen character will make choices that influence the rest of the game, "the future". From time to time, your character will die due to a bad or a wrong choice, but then the game simply starts over from an earlier point, "the past", and lets you try out other options. In a world of time travel, would we consider it our *right* to explore alternatives in the past, just like we have the right to start over in the computer game? Would we assert this right to start over even on the expense of others? The game is always about the own gain, and the suffering of others is not important. Sallie McFague finds that today, it is the individual's rights and not their responsibilities that are primary to many Americans, including the right to carry a gun or to do as one pleases.¹²¹ For McFague, a new form of Christianity, acting for the benefit of everything in the world, is the solution. The aim is to save the future, and the question is how well suited this new Christianity would be to promote responsibility when going to the past?

5.4 Meaning

Apart from the question of responsibility, there is also the question whether time travel to the past would be meaningful. The time traveler may be free to change or affect the past, but should he? Griffin (1986) holds that if we do not have the freedom to at least partially create the present and the future, life would be meaningless. Backward time travel means the possibility to participate in the creation of the present and the future by changing or affecting the past. This implies the freedom that Griffin finds so essential, but would the time travel actually promote meaning or rather remove it? Thalén states that when modern man became free to realize all his own projects, this also became all he *could* do; the sense of these projects belonging to a bigger context was lost, and the only meaning provided was the one he

¹²¹ McFague (2001) p 82-83.

could create on his own.¹²² The problem, as shown by the experiments conducted by Kray et al. (see above), is that attempts to actively create meaning are likely to fail.

As mentioned earlier, the experiments by Kray et al. showed the importance of a sense of fate to make events meaningful. Going back in time means *changing* fate and, as Frankl states, then it is not fate at all.¹²³ It then seems that the only way for the time traveler to achieve a sense of fate would be by deciding *not* to go back in time, instead accepting the way events have turned out. If all is considered well as it is, many reasons for going to the past would be removed. Thus, if actively deciding to go to the past, this would often mean that the time traveler does *not* agree that all is well. Is there any other way of coping with this than attempting to undo the past? McFague stresses that the world is complex: everything cannot be well from all viewpoints all the time; this is the price we have to pay for complexity, change, and beauty.¹²⁴ Eva Hoffman believes that our choices, our lives and our relations become meaningful because we know that each moment is unrepeatable, that we are vulnerable, and that loss cannot be undone but has to be mourned.¹²⁵ This is something that most of us in fact seem to realize; the experiments by Kray et al. showed that, by using counterfactual thinking, we will often draw the conclusion that our life is best as it is, even when reflecting on negative events in our past. This contradicts the assumption of Kaye, who finds that counterfactual thinking, by imagining better alternative worlds, is questioning the Christian notion of our world as inevitable and “the best of all possible worlds.”¹²⁶

The experiments discussed above also showed that the possibility of obtaining a positive outlook on life in spite of negative events required some temporal distance from the event itself. This implies a risk of immature decisions to go back in time rather than letting time heal the wounds. Would the unhappy time traveler even consider the possibility that negative events could provide meaning at a possibly much later stage in life? As mentioned earlier, there are also desperate situations where a possibility to go back in time could be seen as the only hope. But would it justify changing the past?

¹²² Thalén (2007) p 115.

¹²³ Victor Frankl (2003) p 82.

¹²⁴ McFague (2001) p 154.

¹²⁵ Eva Hoffman (2009) p 58, see also Victor Frankl (1990).

¹²⁶ Kaye (2010) p 41, 49.

Comfort could possibly be found in Gott's words when facing desperate mourners: "To someone hoping to find a time machine in order to go to the past to save a lost loved one, the most comforting thing I can say is that, as far as we understand today, this can only be accomplished if the many-worlds theory of quantum mechanics is true. And if that is true, then there is already a parallel universe in which your loved one is okay now. That's because all the possible universes exist. Unfortunately, you are just in the wrong one".¹²⁷

If backward time travel using the multiverse solution actually existed, Gott would be right. But would this be enough to stop the time traveler from acting?

Related to meaning is the possible effect of backward time travel on our personal and collective memory. On a personal level, backward time travel could provide a means to once again experience or observe what had been forgotten or repressed, or for various reasons interpreted incorrectly, in the hope of finding meaning. But will clarity always do us good, or do we need the obscure? On a collective level, history serves as our memory. Ronny Ambjörnsson describes history as a constant reinterpretation of the past which enriches our cultural identity.¹²⁸ How would backward time travel affect this reinterpretation and the cultural identity? Nahin and many others imagine the benefits of seeing historical events such as Jesus preaching. To Nahin, it would serve as irrefutable proof for the doubting.¹²⁹ But can we be certain about what we would find? Would it be best to find out the truth regardless of its consequences for our current understanding? And is a truth from the past still valid today without reinterpretation? Reasoning like Nahin's also presumes the possibility of going back to the original future to make use of the knowledge achieved. In the multiverse and "VCR" solutions, this would not be possible. The time traveler would return to another future where his very journey to the past could have changed the whole world, including which questions needed answers.

Another problem relating to memory appears with the "VCR" solution. When "re-recording" new history over the original history, everything would change accordingly, including our memories.¹³⁰ This means that we would never know if and when our memories were changed due to someone going back in time. How would that affect our view of ourselves and the world and how would it affect the possibility of finding meaning in our lives? On the other hand, if one believes that God is able to change the past and also actually does so from time to

¹²⁷ Gott (2005) p 16.

¹²⁸ Ronny Ambjörnsson (2005) p 31.

¹²⁹ Nahin (1999) p 30-31.

¹³⁰ Nahin (1999) p 265-266.

time, this constant change of our memories is already a part of our daily lives without anyone giving it any thought and with no noticeable consequences.

The safest way to find meaning seems to be accepting life the way it is. But are we able to do so in the Western society of today? Eliade compares archaic and modern man in their tolerance of suffering. He finds that without a reason for the suffering, it becomes meaningless.¹³¹ For archaic man, reason was found by taking part in a cosmic cycle with a fate larger and more important than his own.¹³² Christianity transferred the focus to the individual, but suffering could still be tolerated as a punishment from God, or by belief in a better after-life.¹³³ Whether Christian or not, the wider picture is today all but gone, and along with it the acceptance and tolerance of suffering. Does the whole discussion in this chapter show that the wider picture is still much needed? Furthermore, it is often said that in our time we need hope. Do we also need restoration of faith?

5.5 Saving the past?

Considering the dangers of backward time travel, it could be argued that it should be forbidden to practice if it one day becomes physically possible. As mentioned earlier in this study, such a prohibition is one explanation of the absence today of time travelers from the future. Should we even allow research on time travel, considering the way science is connected to other interests, economical and political? Or should time travel be seen as a possibility for mankind to learn about its past and for science to rescue what technology and humans have destroyed, perhaps by bringing extinct species back to the world?¹³⁴ Would this be the ultimate way to assist God in the continuous creation?

¹³¹ Mircea Eliade (2002) p 98-99.

¹³² Eliade (2002) p 129-130, 132.

¹³³ Eliade (2002) p 122, 136, 147.

¹³⁴ This suggestion obviously opens up for other problems regarding introducing new (or old!) species into existing ecosystems etc.

6 Summary

This study has explored how the research on backward time travel in physics reveals issues which physicists cannot ignore since they are so tightly connected to the subject, but which cannot be handled in a satisfactory way within physics. These issues have to be passed on to more suitable disciplines, philosophy being the discipline which currently takes the greatest interest in the subject. In doing so, mainly by debating paradoxes and their possible solutions, philosophy shows knowledge and respect for the physics involved. However, the interdisciplinary areas covered by philosophy are limited. Whereas free will and determination is of interest, other topics such as meaning and responsibility are not treated.

Like philosophy, theology, especially when inspired by process philosophy, is also inspired by and highly respects the findings of physics. However, while coming close to the subject of backward time travel, even accepting and discussing the underlying physics, the possibility of returning to the past is dismissed without further argumentation. The assumption of this study is that this may be the result of taking physics too seriously. Backward time travel is discussed in classical terms and becomes a matter of belief and feasibility. Theology also ignores faith as a means to approach the subject of backward time travel, although the discussion on post hoc prayer almost reaches the subject by connecting faith with the possibility to affect the past.

Exploring the interdisciplinary questions further, it turns out that they should be of interest to several types of theology, not least the more action-oriented branches such as eco-theology. By focusing on the consequences of backward time travel rather than believing or not believing in its feasibility, the study of backward time travel becomes valuable not only as a thought experiment on a physical possibility that may or may not be actualized in a far future, but as a means of examining and highlighting issues of great importance in our world today. It involves topics such as producing meaning in a world of danger and unpredictability; construction of personal identity; freedom and dependence; responsibility and power; memory and history; known and unknown. It may also involve faith.

7 Further study

All topics revealed above merit further study, within theology or within other disciplines. Below are some additional topics that were not covered in this study, but which I find of interest.

Contemporary narrative on time travel

Writers such as Nahin lead us to believe that scientists are the authorities on time travel. He believes that narrative needs to adhere to the rules set by science; they must use credible technology etc. Contemporary stories about time travel rarely use such credible technology but rather let the time travel take place involuntarily or with the help of magic etc. To Nahin, such stories have no *real* value, apart from the possible entertainment. But what do these other stories talk about? Not about the science or machines, but about men and women or even children, about lost loves, about trying to make wrongs right, about comfort and acceptance. They also often consider the negative aspects of time travel: not getting what you want, the need for sacrifice etc. What do we learn about temporality and life from them?

Time travel, a health hazard?

Counterfactual thinking is essential for our health, and diminished capacity for such thinking is seen in disorders such as Parkinson's disease and schizophrenia.¹³⁵ At the same time, Antje Jackelén and Eva Hoffman see how manipulating time and not accepting temporality may lead to mental disorders such as psychosis or depression, the loss of identity, borderline personalities and compulsive disorders.¹³⁶ This would seem to imply that there may be health hazards with time travel. Indeed, in recent narrative (books, films, and TV series) time travel is often accompanied with physical injuries. How should we interpret this? Are the injuries to be seen as a punishment for violating temporality? Is it a type of sin?

Furthermore, does changing the past remove the possibility for forgiving and healing?¹³⁷ If undoing my mistakes, I remove the possibility of being forgiven for them. Does this apply also on a higher level: does the whole creation need its mistakes, in order to be forgiven for them and learn from them?

¹³⁵ Kray, et al. (2010) p 107.

¹³⁶ Jackelén (2005) p 231; Hoffman (2009) p 98, 101-102, 105, 111-112.

¹³⁷ Ann Heberlein (2007) p 207-208.

The theological interest in boundary questions

Many of the journal articles relating philosophy to the issue of backward time travel have been found in the *Zygon Journal of Religion & Science*.¹³⁸ This journal, as well as the works of Jackelén (2005) and Barbour (1998) are supported by the John Templeton Foundation.¹³⁹ Antje Jackelén has also been director of the Zygon Center for Religion and Science at the Lutheran School of Theology at Chicago.¹⁴⁰ One very obvious effect of this large but yet limited network of authors and publications is that the theological reasoning is often influenced by process theology. I find this very interesting and also somewhat worrying. What are the effects of so few and yet very visible actors and what kind of research is stimulated and supported? Why is there so little interest from mainstream theology in boundary questions such as those discussed within *Zygon*?

¹³⁸ <http://www.zygonjournal.org/>.

¹³⁹ <http://www.templeton.org/>.

¹⁴⁰ <http://zygoncenter.org/>.

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