

voor mijn schatten Lies, Lana en Merel

Promotor Prof. dr. Johan Braeckman
 Vakgroep Wijsbegeerte en Moraalwetenschap

Decaan Prof. Dr. Freddy Mortier
Rector Prof. Dr. Paul Van Cauwenberge

Alle rechten voorbehouden. Niets uit deze uitgave mag worden verveelvoudigd, opgeslagen in een geautomatiseerd gegevensbestand, of openbaar gemaakt, in enige vorm of op enige wijze, hetzij elektronisch, mechanisch, door fotokopieën, opnamen, of enige andere manier, zonder voorafgaande toestemming van de uitgever.



Faculteit Letteren & Wijsbegeerte

Stefaan Blancke

*Towards an integrated understanding of
creationism in Europe*

*Historical, philosophical and educational
perspectives*

Proefschrift voorgedragen tot het behalen van de graad van
Doctor in de Wijsbegeerte

2011

Acknowledgements

Writing this dissertation has often proven to be a rewarding but solitary ordeal. This does not entail however that it has exclusively been a one man project. During the past four years in which I have been preparing my doctorate, I had the pleasure and honour to meet, talk and collaborate with a number of talented and inspirational people whose enthusiasm and advice not only motivated me to continue with my work, but also greatly improved it. In that regard, I owe infinite gratitude to my supervisor Johan Braeckman, without whom these experiences would not have been possible. Not only did he have confidence in me at times when this was anything but self-evident, supporting me to obtain a grant for starting my research. He also guided me in finding the right people at the right time in the right place (which, in the case of our research group, turned out to be a smelly basement room). Moreover, he personally embodied an inexhaustible source of rich ideas, moral support and witty remarks from which this dissertation has benefited tremendously. Thank you, Johan.

Speaking of talented and inspirational people, I definitely owe special thanks to my co-authors: Johan Braeckman, Maarten Boudry, Johan De Smedt, Helen De Cruz, Hans Henrik Hjerimitslev, Peter C. Kjærgaard and Abraham C. Flipse. Their constructive criticism never failed to encourage me to explore unfamiliar research domains, try out new angles and upgrade my standards of depth and quality. This also applies to the conversations and meetings within our research group, The Moral Brain. Further motivation and inspiration I gained from the helpful suggestions by and discussions with Glenn Branch, Coen Brummer, Charlotte De Backer, Willem B. Drees, Taner Edis, Barbara Forrest, Nel Grillaert, Olle Häggström, Salman Hameed, Deborah Kelemen, Bart Klink, Gert Korthof, Laszlo Kosolosky, Rudi Meekers, Ronald Numbers, Peter Olofsson, Mark Perakh, Jos Philippaerts, Massimo Pigliucci, Danny Praet, Michael Ruse, Taede Smedes, Kim Sterelny, John Teehan, Sarah Van Ruyskensvelde, Jackie Wehmueller and a host of anonymous referees.

I would like to thank Maarten Boudry and Hans Henrik Hjermistlev for proofreading parts of the manuscript, Gitte Callaert for her kind assistance with the cover and the lay-out and Kobe van der Beken and Laszlo Kosolosky for translating parts of this dissertation into English. Thanks also to Ghent University for funding my research.

The final words of gratitude I owe to my family, who has incessantly supported me through the process of writing and compiling this dissertation; to my brother Ivo, for keeping me healthy by joining me in a weekly game of squash; and, together with his fiancée Frieke, for conversations over diner or a Duvel or two, which offered me much needed moments of distraction from the project. Thanks also to Arnold en Helena, my parents in law, for taking care of the little blackbird in times of illness or holidays and for providing me with a place to work when my usual workspace transformed into a living room again. I am greatly indebted to my mother Chris, for the enduring trust and loving care she has extended not only to me but to our entire little family, and to Jacques for taking care of her. But I could never have accomplished the task of writing up this dissertation if it hadn't been for the love of my fiancée Marika, who has patiently tolerated again and again to come home to a library after she has spent the day working in one, and find her absent minded scholar in the middle of it; and the love of my three darling daughters Lies, Lana and Merel, whose smiles, ballet dances and K3 sing-a-longs truly make up the highlights of the day. I dedicate this dissertation to them.

List of Abbreviations

AiG	Answer in Genesis
C(R)SC	Center for (the Renewal of) Science of Culture
EO	Evangelische Omroep (evangelical broadcaster)
ID	Intelligent Design

List of Figures

Figure 1	A tree of evil, retrieved from http://www.plasticbag.org/archives/2006/09/the_evil_tree/	15
Figure 2	American views on human origins.....	49
Figure 3	“Human beings, as we know them, developed from earlier species of animals.” True or false? (Miller et al. 2006)	50
Figure 4	Acceptance of evolution in six Muslim countries (Hameed, 2008)	53
Figure 5	Sticker made by Dutch students to protest against the creationist leaflet campaign.....	101
Figure 6	The creationist leaflet “Evolution or creation: what do you believe?”	102
Figure 7	Cover of the first issue of the Dutch creation science magazine <i>Weet</i> (February 2010)	111
Figure 8	Darwin year in Flanders.....	114

Table of Contents

Introduction	1
<i>Part 1- Historical perspectives.....</i>	5
Chapter 1 Creationism, from the Scopes trial to Intelligent Design	7
1.1 Introduction	8
1.2 Growing resistance against evolution	8
1.3 The Scopes Trial.....	10
1.4 Sputnik and the new creationists.....	11
1.5 'Scientific creationism'	12
1.6 The bitter fruits of evolution	14
1.7 Creationism mutates	16
1.8 The importance of design.....	18
1.9 The remedy against the remedy.....	20
1.10 Conclusion	22
Chapter 2 Intelligent Design	23
2.1 Introduction	24
2.2 The Rise of a Movement.....	25
2.2.1 Principles	25
2.2.2 Of Pandas and People.....	26
2.2.3 Phillip Johnson’s <i>Darwin on Trial</i>	26
2.2.4 The Center for the Renewal of Science and Culture (CRSC)	28
2.3 Intelligent Design and the 'new science'.....	28
2.3.1 Behe’s “Irreducible Complexity”	28
2.3.2 Dembski’s “Specified Complexity”	31
2.3.3 Supernatural or theistic science	33
2.4 Intelligent Design and the New Culture	34

2.4.1	The Wedge	34
2.4.2	Phillip Johnson and 'modernism'	35
2.4.3	Natural law: the road to theocracy	36
2.5	Dover, 2005	37
2.6	Conclusion	38
Chapter 3	Creationism in Europe. Facts, gaps and prospects	41
3.1	Introduction	42
3.2	The facts	42
3.2.1	Historical studies	43
3.2.2	Quantitative studies	48
3.2.3	Explanatory studies	53
3.2.4	Other studies	57
3.3	The gaps	57
3.4	The prospects	59
3.5	Conclusions	61
Chapter 4	Catholic responses to evolution, 1859-2009: local influences and mid-scale patterns	63
4.1	Introduction	64
4.2	Early Vatican responses to evolutionary theory, 1859-1907	65
4.3	Catholics respond to evolutionary theory, 1859-1950	70
4.4	Vatican responses to evolutionary theory, 1907-2009	76
4.5	Conclusions	78
Chapter 5	Creationism in the Netherlands	79
5.1	Introduction	80
5.2	The rise and fall of Intelligent Design: The story of Cees Dekker	81
5.2.1	Intelligent Design on the way in	81
5.2.2	A glorious accident	84
5.2.3	But is it science?	86
5.2.4	Intelligent Design on the way out	88
5.3	Andries Knevel and the Evangelical broadcaster: The struggle over science and Genesis	90
5.3.1	Knevel and the EO: an introduction	90
5.3.2	Knevel and Intelligent Design	92
5.3.3	Shared anti-evolutionism	93
5.3.4	Knevel's heresy	96
5.4	Young-Earth creationists unite	99
5.4.1	Distribute the word	99
5.4.2	The aftermath	104
5.5	Conclusions	106
5.6	Epilogue	106

Chapter 6	Creationism in the Low countries: a comparative study	109
6.1	Introduction	110
6.2	Dutch creationist activism since the Darwin year	110
6.3	Religious responses to the Darwin year in Flanders	113
6.4	Political concerns over creationism	117
6.5	Creationism and antievolutionism in Flanders.....	120
6.6	Looking for answers	125
6.7	Conclusions.....	129
 Part 2 – Philosophical perspectives		131
Chapter 7	Simulation of biological evolution under attack, but not really.....	133
7.1	Background: No Free Lunch and Intelligent Design	134
7.2	Ronald Meester, No Free Lunch and simulations	135
7.3	Difficulties.....	136
7.3.1	Setting a target	136
7.3.2	Built with insight into the future?.....	137
7.4	Conclusion	138
Chapter 8	Evolved to be irrational? Evolutionary and cognitive foundations of pseudosciences.....	139
8.1	Introduction	140
8.2	The evolved mind	140
8.3	The evolution of cognitive bias	142
8.4	Pseudoscience and content biases: creationism as a case study	144
8.4.1	Psychological essentialism.....	144
8.4.2	Teleology.....	145
8.4.3	Detecting agents and the intentional stance	147
8.5	Discussion	150
8.6	Context biases, or why pseudoscience?	151
8.7	Conclusions.....	152
 Part 3 – Educational perspectives		153
Chapter 9	The implications of the cognitive sciences for the relation between religion and science education: the case of evolutionary theory.....	155
9.1	Introduction	156
9.2	Religion and biological education: are they compatible?.....	157
9.3	The naturalness of religion	159
9.3.1	Essentialism.....	160
9.3.2	Teleology.....	160
9.3.3	Agency detection, intentionality and the design stance.....	162

9.4	The unnaturalness of science	163
9.5	(Mis)understanding evolutionary theory	164
9.6	Religion and the understanding and acceptance of evolutionary theory	166
9.7	Compatibilism revisited.....	169
9.8	Implications for science education	172
9.9	Conclusions.....	173
Chapter 10	Dealing with creationist challenges. What European biology teachers might expect in the classroom	175
10.1	Introduction	176
10.2	Educational background and motivation.....	176
10.3	The science behind evolutionary theory	179
10.4	Evolutionary theory	180
10.5	Evidence	182
10.6	Implications for education	185
	General conclusions	187
	Bibliography.....	193
	Appendix Civil initiative Fair Science	213

Introduction

Until recently, creationism was largely ignored by European scholars. One might argue that this was entirely justified by the fact that creationism has only been a marginal phenomenon in Europe. However, as we will see shortly, European creationism, in the sense of antievolutionist activism, is on the rise and has even managed to wedge its way into the higher echelons of European politics. In recent years, several European ministers of education have come out in support either of banning evolutionary theory from, or introducing creationism into the biology class curriculum. As a result, the number of European scholars taking an interest in the subject has risen steadily. Nonetheless, the research on creationism in Europe is still very much in its infancy. With this dissertation I hope to give some new thrust to this newly emerging and developing field of research and, in the same breath, make my own humble contribution to it. Furthermore, I hope that the approach – or rather, the approaches – I take here might help set out the markers for research to come. Although in itself this dissertation can be viewed as the official ending of four years of research, it might also be considered as one of the stepping stones *towards* a larger research project in which creationism in Europe is studied in a sustained and consistent effort by scholars from many different European countries. Intense collaboration with colleagues from Aarhus University (Denmark) and a book project supported by the John Hopkins University Press in Baltimore are the first promising signs that such a research project will become realized.

But why study creationism? Even if creationism is on the rise in Europe, one may object, the phenomenon hardly warrants any serious academic attention. At first sight, creationist beliefs are hopelessly simple-minded: creationists hold that their holy books should be interpreted literally, that god created the earth and all life on it, and that you can only go to heaven if you cling to these beliefs. They regard evolutionary theory as the great enemy, because it contradicts a literal interpretation of creationist stories and

hence puts everything at stake, including the heavenly reward that awaits the creationist believer. Why would an academic waste any time with such fundamentalism, when there are so many genuinely interesting roads of inquiry to be explored? The answer is that, when you take a closer look, creationism has many fascinating aspects to it, each of which requires a different angle or perspective for doing research: As an ever evolving cultural movement, it requires a historical perspective; as a pseudoscience, creationism touches on the domain of philosophy of science; as a socio-religious phenomena, it can be studied within sociology and anthropology; when creationist groups start pushing their political agenda, their actions become of interest to political researchers; as a religious competitor of biological science it involves the intensively debated relation between science and religion; the distribution and dissemination of creationist beliefs help to understand cultural evolutionary processes, and the way in which these beliefs hinder acceptance of evolutionary theory is of great interest to science educators and the philosophy of education. As such, these examples not only suggest that the study of creationism in Europe can be undertaken from within several research domains, but also that it can offer a substantial contribution to these respective fields. Ideally, in the end the results of the several lines of research should not stand isolated within each domain, but should become incorporated into a corpus of knowledge concerning creationism in Europe. Only then will we be able to attain a truly integrated understanding of this intriguing phenomenon.

In order to give an indication of what such an integrated approach might look like, I will approach European creationism from several perspectives, which can be roughly arranged in three categories. First, I develop a historical perspective. The history of Protestant fundamentalism and creationism in the United States is abundantly documented. However, the history of creationism in Europe remains largely unknown territory. The first section of this dissertation is intended as a step towards closing this gap. In the first two chapters, as an introduction to the subject and a reference frame, I provide a historical overview of the developments in the United States involving creationism and Intelligent Design (ID) respectively. In the third chapter, I present a review of the literature on creationism in Europe. I discuss the three main types of studies that are available, identifying major gaps and hinting at the most valuable prospects. In chapter 4, I explore Catholic responses to evolutionary theory from 1859 till 2009, in search for local factors and mid-scale patterns. In chapter 5, I offer a historical discussion of creationist incidents and activities in the Netherlands over the past ten years. The historical section is concluded by chapter 6, in which I render an overview of antievolutionist and creationist incidents and sentiments in Belgium, particularly in Flanders. I also offer some suggestions as to what factors might account for the difference between creationist activism in the Netherlands and Flanders.

In the second section, I develop a philosophical perspective. Such an approach is not only necessary for clarifying the issues and concepts involved in the study of

creationism, but also adds to our understanding of how creationism appeals to particular predispositions, both cultural and cognitive. These “talents” facilitate the dissemination of creationism considerably. In chapter 7, I take issue with an article written by Ronald Meester, a Dutch mathematician who sympathizes with Intelligent Design. On the basis of the No Free Lunch theorems, Meester argues that simulations of evolution by natural selection cannot accurately reflect how natural selection works, because such simulations are designed, directed at a target and therefore intrinsically teleological. I show that Meester confuses at least two distinct meanings of “teleological” and that simulations of evolution by natural selection are in no way harmed by Meester’s analysis. In chapter 8, an approach inspired by the cognitive sciences sets out to explain why the human mind is so vulnerable to believing in pseudosciences in general and creationism in particular.

The third section, in which I take an educational perspective, has been inspired by a personal and parental concern with promoting the teaching, learning, and acceptance of evolutionary theory. I believe a sound understanding of evolutionary theory is important for several reasons. First, I am convinced that a democracy can only function properly to the extent that it consists of a population of well-informed, well-educated civilians. Because evolutionary theory constitutes the theoretical ground in which the biological sciences are anchored, the theory can be considered one of the most significant achievements of modern science. Not knowing about or poorly understanding the theory amounts to a form of scientific illiteracy that is unacceptable for a democratic state. The second reason is of a more practical nature. If students do not learn about evolutionary theory, they are deprived of many professional opportunities. This is not so much because they will be cut off from an academic career in the evolutionary sciences, because the odds in that regard are quite low. Rather, over the last couple of decades, evolutionary theory has become increasingly important for the development of technological innovations and practical applications in a range of domains such as agriculture, medicine, engineering and software development. The third reason is philosophical. Because evolutionary theory deals with the living world which we are part of, it has far-reaching consequences for our understanding of the world we live in and of ourselves. With the realization that the human brain too is the product of evolution, and that it plays a central role in the production and propagation of culture, evolutionary theory forms a crucial component of our understanding of human thought and behavior and cultural phenomena.

For these reasons, I have given several public lectures and contributed to the website *evolutietheorie.be*, which is part of a Flemish outreach and education project about evolutionary theory (Blancke, 2009d, 2009e). I was also given the opportunity to publish a booklet in which I explain the “essentials” of evolutionary theory (Blancke, 2009b). Here, in two chapters, I discuss the impact of religious and creationist beliefs on biological education. In chapter 9, I expand on the cognitive approach adopted in

chapter 8 and examine the implications of the cognitive sciences for the relation between religion and science education. In chapter 10, we discuss the particular creationist challenges that European biology teachers can expect in the classroom and how they can prepare themselves to deal with them.

Part 1- Historical perspectives

Chapter 1

Creationism, from the Scopes trial to Intelligent Design¹

Abstract

This chapter renders an overview of the history of modern creationism, from the antievolutionary movement in the 1920s till the emergence of Intelligent Design in the 1990s. It discusses how creationism has adapted itself to the context set by the American Constitution, and indicates why the phenomenon is not likely to disappear. One of the main reasons why creationists will continue to oppose evolution is that they believe that the teaching of evolution has dreadful consequences for man and society. Hence, when engaging with creationist arguments, it is important not just to tackle the so-called evidence against evolution, but also their moral concerns.

¹ This chapter has been adapted from a chapter written in Dutch that is due to appear (accepted by the editors, anonymous peer-review under way, forthcoming end 2011) in Praet, Danny & Nel Grillaert (eds.) *Christendom en Wetenschappen*, Gent: Academia Press, Gingko series.

1.1 Introduction

When we speak of creationism today, we almost instantly think of young-earth creationism, the belief that God created the earth and the human species six to ten thousands of years ago, as described in the book of Genesis. Today, this is indeed the most ubiquitous form, but other varieties of creationism also exist. Day-age creationists, for example, accept the geological proof of an old earth and they interpret the days in the biblical creation story as periods of millions of years. Gap creationists however, assert that the creation story in Genesis is interrupted by a very long pause after the first day. These different fractions do not really form a homogeneous group. They accuse each other of heresy and they all want to justify their own opinions with their own selection of Bible quotes (Pennock, 1999). Throughout history, creationism has actually never been quite the same. In the seventies, scientific creationism emerged and from the nineties onwards, Intelligent Design has been all the vogue.

In spite of this great variety of contradictory opinions, creationists have one thing in common: an intense aversion to evolutionary theory. This aversion is like a connecting thread throughout the entire history of creationism. This can also be found in William Jennings Bryan's pleas during the Scopes Trial in 1925, as well as in the most recent work of Phillip Johnson, the godfather of the Intelligent Design movement. But where does this aversion to evolutionary theory come from? Sometimes, creationists seem to have *scientific* objections against evolution theory. Moreover, creationism has been presented more and more as a science. The mere repetitions of the same -false or long refuted - arguments however, do not really prove to be helpful to science. There must be more behind it. With this brief outline of the history of modern creationism, we would like to explain what exactly that is.

1.2 Growing resistance against evolution

We start in the first decade of last century. During this period, some phenomena emerge that are determinative for the strong antievolutionary movement of the 1920s. Between 1910 and 1915, the *Fundamentals* are published. In these twelve books, which the current use of the concept 'fundamentalism' is derived from, the principles of Protestantism were expounded on the basis of ninety essays. They mainly defended orthodoxy against certain movements within Protestantism that made a free interpretation of the Bible

possible. Their main purpose was thus to re-establish the authority of the Bible. In the meantime, at the beginning of the twentieth century, evolution had become part of the curriculum in the American schools. At the beginning, this did not create much controversy, but a reform of the American educational system resulted in more children becoming aware of evolutionary theory. Due to this, many children of textualist Protestants were also taught evolutionary theory, which caused commotion among their parents. From 1917 onwards, the United States of America were involved in World War I. The American citizens experienced the terrible consequences of the killings in the European trenches. Many young Americans were killed in Europe or came back crippled. Some politicians associated the aggressive German militarism with the theory of the survival of the fittest that, according to them, was implied by evolutionary theory. They turned against the theory because of its malign consequences for man and society. And soon, these politicians discovered that the conservative protestants could be their ally (Larson, 2003; Numbers, 2006).

One of those politicians, William Jennings Bryan (1860-1925), took the lead in the anti-evolution movement at the beginning of the 1920s. At the beginning of the twentieth century, this Democrat had already run three times for president to no avail. At the beginning of the twenties century however, he made convenient use of his political fame to harden and reinforce the resistance against evolutionary theory. He travelled around the country to deliver speeches and called on actions against the teaching of evolutionary theory in class. Thanks to his great rhetoric skill, his efforts were successful. Five states took measures against the spreading of evolutionary theory. In three of them, Mississippi, Arkansas and Tennessee, a law was passed to prohibit the teaching of (human) evolution (Larson, 2003). The law of Tennessee was passed on March 23, 1925. This law stated that a teacher could not teach theories that contravened the biblical creation story and that asserted that humans descended from monkeys.² However, a response was not long in coming. The American Civil Liberties Union (ACLU) quickly looked for teachers who wanted to cooperate with them to put this law to the test. It was their goal to eventually take this law to the American Supreme Court in order to have it declared unconstitutional. They found an appropriate candidate to help them, named John T. Scopes. He admitted to having talked about evolutionary theory in his classes and was consequently arrested. The Monkey Trial came to life (Larson, 2003, 2006; Numbers, 2006).

² The exact text reads: "(...) it shall be unlawful for any teacher in any the Universities, Normals and all other public schools of the State which are supported in whole or in part by the public school funds of the State, to teach any theory that denies the story of the Divine Creation of man as thought in the Bible, and to teach instead that man has descended from a lower order of animals." Butler Act, public acts of the state of Tennessee (C. C. Young & Largent, 2007, p. 148)

1.3 The Scopes Trial

It was boiling hot in Dayton, a small town in Tennessee, when the trial started on 10 July, 1925. The media were massively present to report what was going on during this legal battle. All journalists, some of which came from abroad, expected a big spectacle. After all, the prosecution was supported by no less a person than William Jennings Bryan himself, the great man who had started all the fuss about evolutionary theory. His opponent, the lawyer of the accused, was Clarence Darrow, a brilliant lawyer who was notoriously anticlerical. The people got what they came for. Bryan went on at evolutionary theory with great rhetorical talent. In his final plea, he called evolutionary theory 'a dogma of darkness and death'(Bryan, 2007, p. 162), 'a poisonous doctrine' that was 'as deadly as lepra' (p. 165). According to Bryan, it would devolve our responsibility, undermining our morals and depriving us from our hope to eternal life. 'Evolution strikes out the stars and deepens the gloom that enshrouds the tomb.' (p. 160)

Bryan also questioned the scientific nature of evolutionary theory. He called it an 'irreligion' (p. 156) and described it as 'millions of guesses strung together' (p. 158). However, when asked how many scientists subscribed to his viewpoints, he could only mention two persons. Furthermore, he also came off worst during a direct confrontation with Darrow, who questioned him about the contradictions in the Bible. Nevertheless, Bryan won. As expected, John Scopes was sentenced to a fine of one hundred dollar. After all, he had broken the law. The way to the Supreme Court was now paved. However, Scopes' sentence was later suspended because of a procedural error and the ACLU could no longer appeal. As a result, the law remained valid: the teaching of evolutionary theory was still prohibited in the classes of Tennessee (Larson, 2003, 2006).

Despite these setbacks, the trial is sometimes presented as a moral victory of evolutionary theory's advocates. Due to the bold questions of his opponent, Bryan had indeed lost face. By no means, however, could it be called a victory. The consequences for the teaching of evolutionary theory were disastrous. The theory was taught less and less at school. In order not to run up against their fundamentalist customers, publishers made the best of a bad bargain. They deleted evolutionary theory from the school books. These books, however, were sold all over the United States of America. This is how evolutionary theory almost entirely disappeared from American education (Bowler, 2007; Larson, 2003; Numbers, 2007). Bryan didn't only triumph during the trial. His entire movement against evolutionary theory was a success. Nevertheless, he did not live to see it. Five days after the termination of the trial, Bryan deceased in his sleep, exhausted by the many efforts before and during the trial.

After Bryan's death, the resistance against the evolutionary theory grew stronger. In 1926 and 1928, respectively, Mississippi and Arkansas approved a law against the

teaching of evolution in class. On a local scale, it was mainly the southern states who took anti-evolutionary measures. Nonetheless, around 1930, the creationist fire died out slowly. It made less and less sense to fight against evolutionary theory, because it seemed to be disappearing naturally. The ACLU still wanted to challenge the three anti-evolution laws by having someone teach evolutionary theory, but they did not find a suitable candidate. There was no one prosecuted based on the anti-evolution laws. Eventually, the ACLU also rested their case (Larson, 2003, 2006). This was the beginning of thirty years of lethal anti-evolution silence in the United States of America.

1.4 Sputnik and the new creationists

We make a leap to the year 1957. That year, the Russians were the first to succeed in launching a satellite, the Sputnik, in an orbit around the world. The Americans were astonished. In the space race with the Soviets, they seemed to come off worst. The culprit was quickly found in the lamentable state of science education. As a remedy, the *National Defense Education Act* was passed in 1958. Committees were established in order to rewrite the school books. Also biology textbooks underwent drastic changes. During the twenties and thirties, biologists and population geneticists had connected Darwin's theory of evolution by natural selection with Mendelian genetics. Since evolutionary theory was now backed by genetics, during the fifties, it grew stronger than ever. In short, whoever wanted to write a biology textbook based upon the best then currently available knowledge could impossibly ignore evolutionary theory. As a result, the theory came back into the classrooms (Bowler, 2007; Larson, 2003; Numbers, 2006, 2007; Scott, 2004). But not only evolutionary theory but also creationism had changed drastically. Although Bryan opposed the teaching of evolutionary theory and defended the creation of man as described in Genesis, he did not defend the idea of a young earth. In that regard, he was anything but an exception. Conservative Christians had accepted geological proof of an old earth rather quickly during the nineteenth century and they had adapted their interpretation of the creation history accordingly (Bowler, 2007). The result were the *day-age* and *gap* interpretations, as mentioned above. Bryan was a *day-age*-creationist himself. Young-earth creationism was, at that time, only defended by the *Seventh-day Adventists*, a sectarian group of about one hundred thousand people. These followers of Ellen G. White, a prophetess of the mid-nineteenth century, insisted on a Sabbath on Saturday and stood by the beliefs that creation had taken place in six literal days and that a flood had covered the entire planet. The most prominent person among

them was George McCready Price, a self-proclaimed geologist. In 1923, he wrote his opus magnum *The New Geology*, in which he stated all 'scientific' proof of a young earth. Among the creationists, Price was no stranger. He was one of the two 'scientists' Bryan had mentioned during the Scopes trial (Numbers, 2006). Price's radical opinions however, were not very popular. Until the 1960s, young-earth creationism would only be one of many voices within the creationist movement.

From the early 1960s onwards, however, the situation changed entirely. Several attempts to bring the creationists under one umbrella during the forties and fifties all failed due to internal disagreements. Especially the young-earth creationists could not reconcile their faith with more liberal interpretations of the Biblical creation history. In 1961 two of them, John C. Whitcomb, a theologian, and Henry M. Morris, an engineer, wrote *The Genesis Flood*, in which they recaptured Price's arguments for a young earth and a global flood. This book marked a turning point in the history of creationism. Two years later, in 1963, the creationists established their own organisation, the *Creation Research Society*, which was quickly pulled in by the young-earth creationists (Morris, 1984; Numbers, 2006; Scott, 2004, 2007). From that moment, young-earth creationism took a steep flight. It did not take long until 'creationist' became synonymous with the young-earth variety (Numbers, 2006, 2007).

1.5 'Scientific creationism'

In 1968, the creationists received a heavy blow. After more than 40 years, the US Supreme Court ruled the anti-evolution law of Arkansas unconstitutional³. The Court argued that such laws did not respect the separation of Church and State and could therefore not be tolerated. As a result, American states could no longer ban the teaching of evolutionary theory in class. This verdict also left little room for the teaching of Biblical creationism alongside evolutionary theory. This option would also be unconstitutional (Larson, 2003; Scott, 2006, 2007).⁴ The fact that their children would

³ The *Establishment Clause* of the first amendment reads: 'Congress shall make no law respecting an establishment of religion'

⁴ A part of the verdict reads: 'The law must be stricken because of its conflict with the constitutional prohibition of state laws respecting an establishment of religion or a prohibiting the free exercise thereof. The overriding fact is that Arkansas' law selects from the body of knowledge a particular segment which it proscribes for the sole reason that it is deemed to conflict with a particular religious doctrine; that is, with a

only be taught evolutionary theory was completely unacceptable for the creationists. In one way or another, they wanted to neutralise evolutionary theory in class by also teaching their own story. According to the Constitution, however, this was impossible. Only scientific, not religious alternatives could stand a chance to be taught. Then, the creationists devised a strategy to have their faith called 'scientific'. And so, '*scientific creationism*' or '*creation science*' arose (Numbers, 2006, 2007; Scott, 2004, 2006). Apart from the name, virtually nothing changed. Already in *The Genesis Flood*, Whitcomb and Morris discussed 'the scientific implications of the Biblical story'. You could only become a member of the *Creation Research Society* when you had a university diploma (Numbers, 2006). After 1968, under pressure of the Constitution, the creationists tried to further legitimise their faith in a 'scientific' fashion. To enforce this development, Morris established the *Institute for Creation Research* (ICR) in 1972. This institute played a crucial role in the promotion of young-earth creationism as a scientific alternative to evolutionary theory (Numbers, 2006, 2007).

Not that all members of the institute conducted a lot of research themselves. They confined themselves to organising debates with evolution scientists - which created a scientific atmosphere - and publishing books. In their books, the scientific creationists followed roughly the following recipe: First of all, narrow down the definition of science to the empiricist opinion that only experiments can deliver valid scientific knowledge. Subsequently, state that evolutionary theory does not meet this criterion: after all, scientists were not present when the universe, life and humankind were created. Nor did they *see* a species evolve into another species. In short, evolution is not a fact, but only a theory. Then, state that the creation model is therefore as valid as the 'evolution model'. Finally, you demonstrate that there are too many problems with evolutionary theory (whether or not real lacunas in the fossil record; the theory allegedly violates the second law of thermodynamics; functional complexity cannot originate on 'coincidence' etc.), which leaves us with creationism as the only plausible model (Gish, 1978; Morris, 1974a; Wysong, 1976). The result is a clear message: creationism deserves to be taught at least together with evolutionary theory. This was also the idea behind their new strategy: striving for *equal time* (Larson, 2003; Scott, 2004). Creationism did well out of the switch to a scientific image. Throughout the seventies, the popularity and the strength of their movement grew dramatically. Morris (1981, p. 5) called this period the "decade of creation". As icing on the cake, two states, Arkansas and Louisiana, passed laws that allot as much time to evolutionary theory as to creationism. If evolution was taught in class, the teacher was also obliged to teach creationist beliefs. The success was

particular interpretation of the Book of Genesis by a particular religious group...' Epperson vs. Arkansas 393 U.S. 97 (1968), in: Scott (2004, pp. 195-196).

however short-lived. Already in 1982, in the *McLean vs. Arkansas* trial, the Supreme Court of Arkansas declared these laws to be unconstitutional. Five years later, the American Supreme Court judged the law of Louisiana in the *Edwards vs. Aguillard* trial. The Court judged that such laws favoured one particular religious viewpoint. Thus they violated the First Amendment of the U.S. Constitution and they were therefore unacceptable⁵. This was the end of the strategy to teach scientific creationism together with evolutionary theory in public schools (Scott, 2004, 2006). However, it is worth noticing that throughout the period creationism was taught in many private Christian schools.

1.6 The bitter fruits of evolution

Despite the drastic changes creationism had undergone since the twenties, it still showed the same tenacity towards evolution. Moreover, the creationist approach from the sixties, seventies and eighties barely differed from William Jennings Bryan's and his fundamentalist contemporaries. Also in the second half of the twentieth century, the creationists question the scientific status of evolutionary theory. To them, evolution is but a belief with very nasty consequences both for man and for society (Scott, 2004). According to most creationists, evolutionary theory implies that God does not exist and that the human race is reduced to an animal in a world of despair and a ruthless struggle for existence. For instance, Morris (1974b, pp. 166-167) writes:

Instead of training children in the nurture and the admonition of the Lord, better to teach them how to struggle and to survive in a cut-throat world, and then toss them out of the nest. Self-preservation is the first law of nature; only the fittest will survive. Be the cock-of-the-walk and the king-of-the-mountain. Eat, drink, and be merry, for life is short and that's the end. So says evolution!

In the same book, *The troubled waters of evolution* (1974b), you can read what evolutionary theory leads to according to Morris. From social phenomena like sex before marriage, homosexuality, sex education, drugs and belief in the existence of UFOs to political and

⁵ Although it was a very close shave. Due to wrong strategic choices of the prosecutors the judges almost passed the law. A letter from some seventy Nobel price winners and a few scientific organisations, in which they stated that creationism does not meet the criteria to be deemed as scientific, saved the case. See: Shermer (2002, pp. 154-172).

economical systems varying from communism to die-hard capitalism. All this evil is due to evolutionary theory. The same message can be found in drawings that represent evolution as a tree with bitter fruits (Shermer, 2002, p. 134).

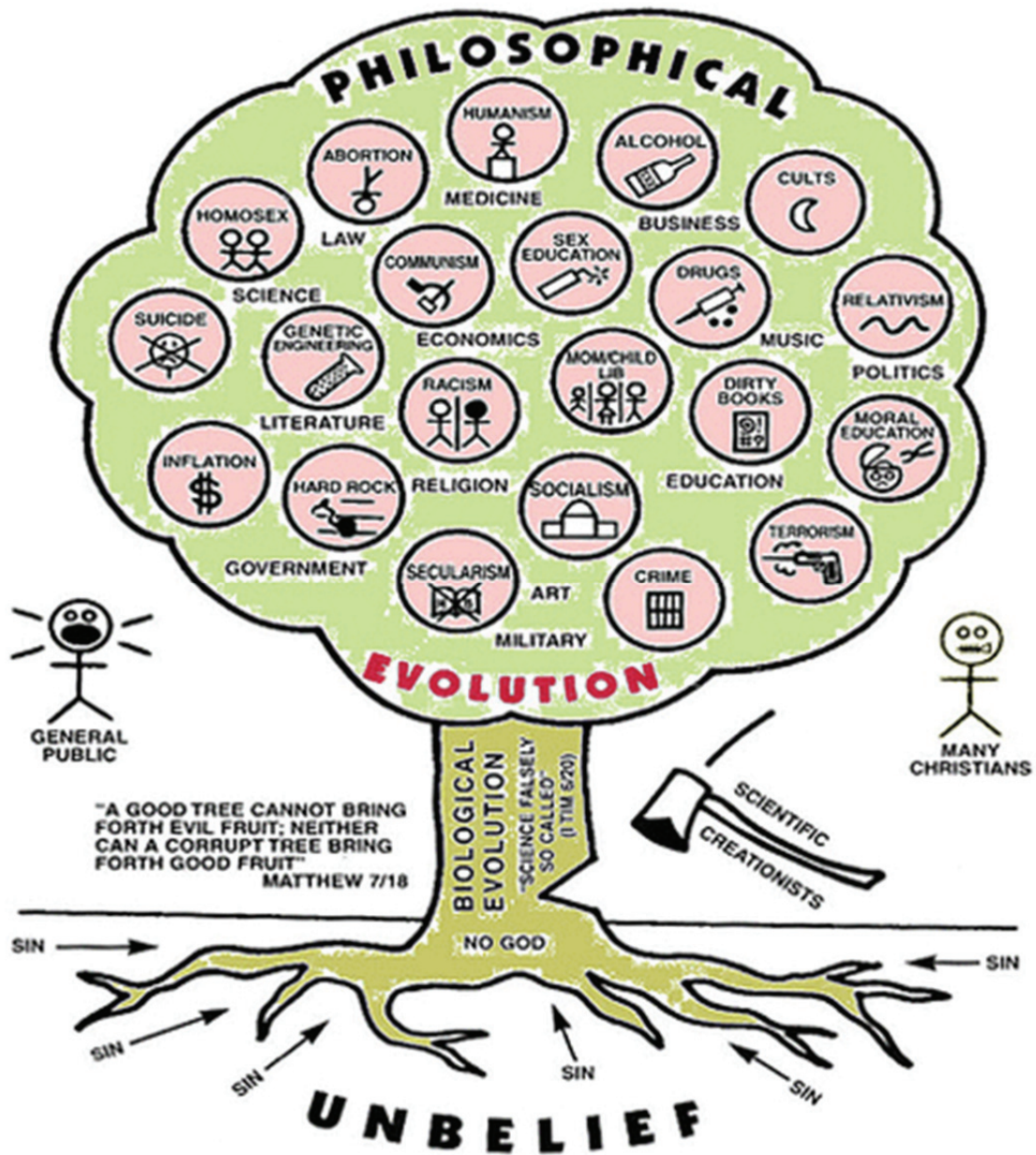


Figure 1 A tree of evil, retrieved from http://www.plasticbag.org/archives/2006/09/the_evil_tree/

This is a reference to a passage from the Gospel of Matthew (Matt. 7: 17-19): “For a good tree bringeth not forth corrupt fruit; neither doth a corrupt tree bring forth good fruit. A good tree cannot bring forth evil fruit, neither can a corrupt tree bring forth good fruit. Every tree that bringeth not forth good fruit is hewn down, and cast into the fire.” With its roots firmly anchored in the atheistic ground, evolution generates new age, hard rock and Nazism, as well as feminism, humanism and secularism. According to

many creationists, evolution is the true source of all evil, the end of a society as God intended it. Evolution can therefore be nothing less than the work of the devil.⁶

Creationists however, do know a remedy against this 'plague': a solid belief in the literal truth of the Bible. In the illustrations, you can see that the axe of scientific creationism is already hewing the tree of evolution (Shermer, 2002). Only when the tree is hewn, and creationism is replaced, human life becomes meaningful. Only then, man can concentrate on eternal life, only then, do we know how to behave. In short, there is a lot at stake for a creationist. This is why the struggle against 'Darwinism' continues up to today. Organisations such as Ken Ham's *Answers in Genesis* and Henry Morris' *Institute for Creation Research* continuously act against evolution. They spread their creationist message through all kinds of channels: from DVDs through Internet sites, from museums to class curricula. And the message does not fall on deaf ears. Recent questionnaires have demonstrated that almost half of the Americans believe that God created the earth a few thousand years ago (Newport, 2006). Also outside the United States of America, creationism is incessantly making converts (Numbers, 2006).

1.7 Creationism mutates

After the decision of the Supreme Court in 1987, the creationists discontinued their plan to restrict or neutralise evolution through laws. Ever since, they have confined themselves to local projects, where they try to influence local authorities or advisory committees on education. In this way, they can continue fighting the teaching of evolutionary theory without really being noticed. But not only has the strategy changed. In response to the verdict of 1987, a new mutation of creationism emerged which quickly took its place alongside young-earth creationism as an "alternative" to evolution: *Intelligent Design* (Numbers, 2007; Scott, 2007).

The Intelligent Design movement is based upon the conception that certain forms of complex functionalities exist in nature that did not emerge through evolution and natural selection. Therefore, the Darwinian theory of evolution cannot explain these phenomena, which means that we must assume that an intelligent designer is behind it.

⁶ Bryan (2007, p. 170) depicts the choice between the creation history and evolution as a "choice between God and Ba'al". Whitcomb and Morris (1961, p. 447) state that Satan is the originator of the "evolutionary lie". Thirteen years later, Morris (1974b, p. 75) writes: "Satan himself is the originator of the concept of evolution."

This type of argumentations is far from new to creationism. Already in the seventies, Morris and his team had summed up many examples of biological complexity that would put evolutionary theory in dire straits: the eye, the wings of birds, the Bombardier beetle etc. Intelligent Designers, however, prefer the complexity on cell level and in biochemical processes. The best known example is that of the bacterial flagellum, but they also refer very often to the blood clotting process of the human immune system (Behe, 2006). According to them, only an intelligent designer can be responsible for such complexity.

Intelligent Design advocates, such as Michael Behe and William Dembski, claim to have objective criteria to discover intelligent design in nature (Behe, 2006, 2007; Dembski, 1998). According to them, this is a way to scientifically trace where an intelligent designer has been at work. According to its advocates, intelligent design is not a faith, but a genuine new science. To enforce this argument, Intelligent Designers deliberately stay vague about the designer's identity or they boldly state that it is irrelevant for their “science”. Moreover, they are no longer interpreting Genesis literally - although some of them are in fact young-earth creationists - and accept that some form of evolution took place. Michael Behe even claims to accept the concept of common descent. In this way, Intelligent Designers wish to disassociate themselves from young-earth creationists, highlighting the scientific character of their views. They also formally create the impression to be “real scientists”. They write books full of learned words, probability calculations and formulas, all with footnotes and a comprehensive bibliography. They organise congresses to which they invite recognized science philosophers and scientists (or they lure them to it with lies⁷). In their publications, they show off with their doctor degrees, that seem to merge all together with their names. All this to sell Intelligent Design as a science.

Although the packaging may suggest that we are dealing with science, the content of Intelligent Design leaves much to be desired (Pennock, 1999; Perakh, 2004b; Petto & Godfrey, 2007; Sarkar, 2007; M. Young & Edis, 2004). Already in the seventeenth, eighteenth and nineteenth century, natural theologians like John Ray, Bernard Nieuwentyt and William Paley used functional complexity as proof for the existence of an intelligent designer (Braeckman, 1997, 2008; Dawkins, 2006 [1986]). Intelligent Design as a “theory” is but a modern version of this design argument: if something looks designed, it must be designed. Today however, we know that “design” is the result of an

⁷ Forrest & Gross (2007[2004]) describe how Paul Chien from the Intelligent Design movement lured many renowned palaeontologists to China for a conference on remarkable findings from the Cambrian period in China. When the scientists found out that creationists had organised the conference, they refused to participate any longer in the conference. The creationists' plan to publish the presented papers was off as well.

evolutionary process that selects and safeguards mutations based upon survival and reproductive benefits the carrier possesses. An eye no longer requires an “eye designer” nor does a flagellum need to be made by a “flagellum designer”⁸. We owe this more than 150 year old insight to Charles Darwin⁹. By now, evolution by natural and sexual selection is one of the most solidly documented theories we have. Intelligent Designers like Behe and Dembski ignore this fact completely as they long nostalgically for pre-modern times in which the explanation of a supernatural designer was still taken seriously (Behe, 2006; Dembski, 1999).

1.8 The importance of design

If evolutionary theory provides us with a nice scientific explanation for complex, biological phenomena, then why do Intelligent Designers keep hammering away at the existence of design as proof for a designer? Why is it so important to them to find signs of supernatural activities in nature? What is so threatening about evolutionary theory that, despite the enormous amount of evidence for it, they still cannot accept it? We can only answer these questions when we take a closer look at the importance of “design”.

On the one hand, “design” seems to give meaning to life. Just like many other creationists, Phillip Johnson (Johnson, 1991, 1995), the founder of the Intelligent Design movement, considers evolutionary theory a godless, materialistic creation story which

⁸ There exists a lot of literature about the evolution of the eye. For instance, see Nilssons and Pelger (1994) and the special edition of *Evolution. Education and Outreach* on the evolution of the eye (vol. 1, issue no. 4, October 2008). A lot is known about the evolution of the flagellum as well. For an overview, see Matzke (2003) and Musgrave (2004). For more information on the importance of evolution as a scientific explanation of 'design', see Dawkins (2006 [1986]).

⁹ Darwin wrote the following about 'organs of extreme perfection and complication' in *On the origin of species* (1859, pp. 186-187): “To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest degree. Reason tells me, that if numerous gradations from a simple and imperfect eye to one complex and perfect can be shown to exist, each grade being useful to its possessor, as is certainly the case; if further, the eye ever varies and the variations be inherited, as is likewise certainly the case and if such variations should be useful to any animal under changing conditions of life, then the difficulty of believing that a perfect and complex eye could be formed by natural selection, though insuperable by our imagination, should not be considered as subversive of the theory.”

reduces nature, including humans, to be a product of “mere chance”. Moreover, if everything is “mere matter”, life - specifically human life - loses all its value. Matter just follows the laws of nature. As such, God and the human soul are thought to disappear from the world and after death nothing awaits us. What are our lives worth, if there is no higher cause to live for? However, if you acknowledge that there exist complex phenomena in nature which you cannot attribute to chance, you can avoid these purported consequences of evolutionary theory. All of a sudden, there is room for a designer - who is, according to Intelligent Designers proponents like Phillip Johnson and William Dembski without any doubt the God of the Bible - who wants to achieve particular goals in this world. This also applies to humans. The existence of a designer gives us a purpose in life. It also guarantees us that we are more than just our bodies. Because deep inside of us, we carry a little piece of divine spirit. Life does not end with death. Instead we receive a heavenly continuation in the afterlife (Dembski, 1999; Johnson, 1995).

But not everyone can enjoy eternal life. If the hand of God in nature is denied, then the creation is worshipped instead of the creator. In other words, if you do not accept the existence of the creator or the designer, then you sin against idolatry. It prevents you from accepting that God wanted to achieve certain values by his creation. As such, God did not only “design” a biological order, but also a moral one. Therefore, good and evil are objectively fixed values. They are absolute. Hence, if you deny the existence of biological design, you also deny the existence of moral design, and therefore, you cannot possibly adjust your behaviour to God's law and genuinely be “good”. Worse still, evolutionary theory tells us that we are just animals who descend from 'apes'. So who will stop us from actually behaving like animals? We would lose our chance to an eternal reward (Dembski, 1999; Johnson, 1995).

In short, it is of paramount importance to discover the influence of God in the functioning of the bacterial flagellum. The existence of intelligent design offers us a deeper meaning of life and makes us behave good. According to Johnson and his team, evolutionary theory deprives us of both. According to them, evolution is a process of mere chance that denies any higher purpose to human life. Furthermore, evolution denies the existence of God, which means that we no longer have to follow his laws. The result is complete chaos and decay on a sexual (moral), political and social scale. Obviously, in these opinions, they have been heavily influenced by young-earth creationism. In *The creation of life* (1970, pp. 237-238), A.E. Wilder-Smith writes:

Human society has been built on two pillars since the dawn of time. The first was that the design of the universe showed some designer, spirit or otherwise, behind it, who was to be feared or revered. The second was that the designer expected some kind of order to be set up among man as a result of the order he had set up in the universe. One pillar influenced the other, but both supported the temple of man on earth. Darwin pulled out the first pillar. The result is that the temple of

man is fast deteriorating into primeval chaos. The destruction of the fear of God has brought with it the terror of man as the second pillar is being pulled down. Man's 'temple' is collapsing about his ears.

Like young-earth creationists, the Intelligent Designers blame evolutionary theory for many things: divorce, premarital sex, abortion, sex education, homosexuality, feminism, euthanasia, drug use, Nazism, etc. Only when we acknowledge 'design' scientifically, do we dispose of the appropriate remedy for the ills of our time (Dembski, 1999; Johnson, 1991, 1995; Wiker, 2002).

1.9 The remedy against the remedy

Intelligent Design does not only assert that evolutionary theory is wrong, it also asserts that it undermines our existence and that it is morally reprehensible. For that reason, it does not suffice to show that the claims of Intelligent Design proponents, like Michael Behe and William Dembski, are wrong – no matter how important this task may be. It is also necessary to explain that accepting evolutionary theory does not have the terrible consequences Intelligent Designers think it has. Robert Pennock (1999, p. 337), a philosopher of science and an ardent opponent of creationism, writes:

Defenders of evolution would help their case immeasurably if they would explicitly reject the creationists' contention that evolution is atheistic, and reassure their audience that morality, purpose, and meaning are not lost by accepting the truth of evolution.

This can be realised in different ways: a number of philosophers, theologians and scientists hold that you can accept evolution without losing faith in God. They point out that science is only *methodologically* naturalistic. The fact that God does not exist within a scientific description of reality, does not mean God does not exist at all. It is only a result of the way science works. If the supernatural was embraced by science, it would immediately mean the end of science: patterns would randomly be interrupted. Furthermore, a scientist would be able to attribute things to God whenever he is stuck with his research. It would mean the end of science. Therefore, science simply *cannot* make statements about the existence of God. The supernatural is beyond the realm of

science.¹⁰ Another way is to demonstrate that evolution does not have the moral consequences the creationists ascribe to it. Many phenomena, such as racism, homosexuality, adultery and divorce, existed centuries before Darwin published his theory of evolution (Pennock, 1999; Shermer, 2002). There also exists an unbridgeable gap between “is” and “ought”. Although nature often works in ways we find disturbing or even disgusting, we are by no means compelled to abide by its example. Nor should we behave like animals because we are “only” animals (Pennock, 1999; Ruse, 2006). Moreover, evolution does not only generate absurd waste and horrible murder. The brilliant colours of flowers and butterflies are also the result of evolution, just like language, cooperation, love and morality. Also, it can be pointed out that life does not lose its meaning by accepting evolution. Stamos (2008), for instance, argues that people give meaning to their lives by gaining knowledge or hanging out with their fiends.

The moral undercurrent of the resistance against evolution suggests that creationists are not likely to cease their struggle. In 2005, a judge in Dover, Pennsylvania ruled against the teaching of Intelligent Design in public education because that would violate the separation of church and state. However, the verdict did not throw them off their balance. After the trial in Dover, a new creationist strategy arose: the anti-evolutionary message is now expressed in good-sounding terms such as *critical thinking* and *academic freedom*, which helped anti-evolutionists to influence local school councils. Even at the legislative level, they are currently successful. In June 2008, the state of Louisiana approved the Louisiana Science Education Act, which, based on its language and focus on evolution, reveals creationist lobbying.¹¹

¹⁰ This view on methodological naturalism has been propounded by Pennock (1999); Miller (1999); Shermer (2002); Scott (2004); Fairbanks (2007); Prothero (2007). For a critical analysis of this view, which is also called “intrinsic methodological naturalism”, see Boudry and colleagues (2010a) (see also chapter 10).

¹¹ This is the text of this Act: ‘The Stateboard of Elementary and Secondary Education, upon request of a city, parish, or other local public school board, shall allow and assist teachers, principals, and other school administrators to create and foster an environment within public elementary and secondary schools that promotes critical thinking skills, logical analysis, and open and objective discussion of scientific theories being studied including, but not limited to, evolution, the origin of life, global warming and human cloning.’ Senate Bill no. 733, 2008.

1.10 Conclusion

Ever since the 1920s, fundamentalist Christians in the United States have fought against evolution. They do not only undermine the scientific nature of the theory; they also assert that it has evil consequences for man and society. Bryan called the theory 'millions of guesses strung together', but also a 'dogma of darkness and death'. According to young-earth scientists, like Price and Morris, the theory of evolution is not a science, but a lie invented by the devil himself. According to Johnson and his team from the Intelligent Design movement, there is almost no evidence for the theory of evolution. The theory only legitimises a world without God and a life without (sexual) inhibitions. Creationists of all ages and all walks of life have several reasons to fight against evolutionary theory. Therefore one cannot disprove creationism by 'merely' pointing out the errors of their factual claims about evolution. Also errors in their moral thinking should be pointed out. Evolution does not eliminate the meaning of life, nor does it lead to immoral behaviour. Clarifying this is essential when 'discussing' with creationists. Because it is the fear of losing meaning and value, rather than a concern for academic quality, which drives creationism.

Chapter 2

Intelligent Design¹

Abstract

Intelligent Design is generally considered to be the most recent version of American creationism. However, because Intelligent Design proponents claim to have objective criteria by which they are able to detect design in nature and because they do not insist on a literalist reading of the the book of Genesis, it is often taken to be a moderate position. This chapters shows that, despite these differences with strict creationism, the historical and ideological roots of the Intelligent Design movement are indeed deeply anchored in creationist soil.

¹ This chapter has been adapted from a chapter written in Dutch that is due to appear (accepted by the editors, anonymous peer-review under way, forthcoming end 2011) in Praet, Danny & Nel Grillaert (eds.) *Christendom en Filosofie*, Gent: Academia Press, Gingko series.

2.1 Introduction

In May 2005, the Dutch minister of Education Maria van der Hoeven for the Christian democrats encountered strong opposition when she proposed to discuss the inclusion of Intelligent Design in biology education as an official scientific alternative to evolution. Her interest in Intelligent Design was aroused after a discussion with Cees Dekker, physicist at the Delft University of Technology. Dekker is an influential nanotechnologist. In 2003, he won the Spinoza Prize (Spinozapremie), the most prestigious award for science in the Netherlands. Because of the resulting commotion, van der Hoeven quickly withdrew her proposal. At the moment, she is no longer in charge of the Ministry of Education and Cees Dekker has renounced Intelligent Design. He is now a theistic evolutionist and claims to accept the evidence for evolution (see also chapter 5).

However, this is not an isolated incident. All over Europe, politicians have argued that evolutionary theory should no longer be taught or that at least Intelligent Design should be included as an equally valid alternative to evolution (see chapter 3). In October 2007, the Council of Europe even deemed it necessary to warn about the dangers of creationism. But is Intelligent Design really a type of creationism? Adherents of this theory claim to possess strong, scientific evidence against evolutionary theory. They hold respectable diplomas, do not use the Book of Genesis in their argumentation and they claim to accept the theory of common descent. Intelligent Design cannot be that dangerous, can it? Or, in the words of a lecturer at the Artevelde University College Ghent: “Intelligent Design still includes God as a decisive factor, even though it recognizes many elements of Darwinism. As a scientist, there isn't much one can hold against that.”²

However, in the United States, many scientists and philosophers oppose Intelligent Design. They frequently warn about the consequences Intelligent Design would have for science, education and society. In this chapter, I will examine why Intelligent Design has caused so much turmoil there. First, I will briefly describe the origins of the movement and the concept on which it was founded. Then I will discuss the scientific claims of the main Intelligent Design proponents. Finally, I will look at what the Intelligent Design movement has planned for the future. What are they striving for? In doing this, I intend to deliver an adequate image of Intelligent Design as a concept, a theory and a movement.

² “Darwin zegt niets over zingeving”, *Artevelde Magazine*, 29, January 2009.

2.2 The Rise of a Movement

2.2.1 Principles

The story of Intelligent Design begins in the 1980s when two books were published in which the authors claim that there are certain phenomena in nature that cannot solely be explained by natural processes (Numbers, 2006, 2007; Scott, 2007). The first book, *The Mystery of Life's Origins* (1984), was the result of a cooperation between three American creationists, i.e. chemist Charles B. Thaxton, engineer Walter Bradley and geochemist Roger L. Olsen. In the prologue, Dean H. Kenyon, Professor of Biology at the University of San Francisco, wrote that the authors convincingly demonstrate that the current, naturalistic theories about the origin of life (e.g. “the primordial soup”) fall short. This leads the authors to “the possibility (or the necessity) of a supernatural origin of life” (Thaxton, et al., 1984, p. iix), a concept scientists refuse to consider because of “the fallacy of scientism” (p. iix). The three authors of the book claim that “the modern chemical evolutionary theories of the origin of life are in a state of crisis” (p. 9). These theories are not the result of scientific experiments. Instead, they are founded solely on a metaphysical position: naturalism. When approaching life from the opposite perspective, theism, then it is not as self-evident to only look for natural explanations. An opening is created for a divine intervention (p. 208). Scientists need to draw their conclusions on how life was brought about in a way that is similar to a jury rendering a verdict on a defendant after hearing the arguments of both parties (p. 213). Because natural explanations fall short, Thaxton, Bradley and Olsen argue that it is much more probable that an 'intelligent Creator' is responsible for all life on Earth (p. 210).

The other book, *Evolution. A Theory in Crisis* (1985), was written by the English geneticist Michael Denton. Denton is not a strict creationist, but he is convinced that there is virtually no scientific evidence to support evolution based on natural selection. Denton does not deny that variations have occurred within species over the course of time. The species “cat”, for instance, ranges from the domestic cat to the tiger. Denton argues that one cannot presuppose that this phenomenon, microevolution, can lead to evolution from one type of species to another, i.e. macroevolution (p. 79). He states that the facts supporting this extrapolation either do not exist or they can be interpreted in a completely different manner. Furthermore, the existence of *design* in nature suggests that processes that work only by mere chance cannot account for everything (p. 326). This leads Denton to conclude that the theory of evolution is going through a crisis it will never recover from (p. 16). His book, together with *The Mystery of Life's Origin*, provides the intellectual foundation of the ID movement (Numbers, 2006).

2.2.2 Of Pandas and People

In 1989, Percival Davis and Dean H. Kenyon wanted to release an alternative, creationist textbook for biology lessons. They first named the book *Biology and Creation*, but after the trial *Edwards vs. Aguillard* in 1987, they renamed it *Of Pandas and People*. It was not just the title that was changed, however. Because educators could no longer teach “scientific creationism” as an alternative to evolutionary theory, the authors systematically changed terms like *intelligent creator* and *creation* into *intelligent designer* and *design*. This way, they hoped to circumvent the constitutional restrictions set by the First Amendment, and have their creationist beliefs taught in biology classes under the header of *intelligent design* (Forrest & Gross, 2007[2004]; Numbers, 2006; Scott, 2007).

In *Of Pandas and People* (1993) Davis and Kenyon provide six cases that, according to them, disprove the theory of evolution. They claim to find no decent evidence to support the theory. Small variations (microevolution) could perhaps exist by means of natural selection, but they argue that there is simply no proof to support macroevolution. The fossil record displays numerous lacunas and homologous characteristics can also be given a totally different explanation. Also, the complexity of things like DNA or the human immune system strongly supports the idea of an “intelligent designer”. From our everyday experience with complex, cultural artefacts, we know that they require a designer. Why would this be any different for biological complexity? When we attribute a simple message written in sand to a “writer”, how is it then possible that our much more complex genetic code could have been developed through a series of natural processes? In short, the evidence for evolutionary theory is not as strong as the scientific community wants us to believe. According to the authors, however, there is impressive and consistent evidence for the notion that living things are the product of an intelligent designer (Davis, et al., 1993, p. 148).

2.2.3 Phillip Johnson’s *Darwin on Trial*

Intelligent Design remained a rather marginal initiative until the book *Darwin on Trial* was published in 1991. The author, Phillip Johnson, had no reputation of being a young-earth creationist. He was a respected, now emeritus, law professor at the University of California in Berkeley. As the title of the book suggests, Johnson sets out to be the judge in a trial on the scientific status of evolutionary theory. He admits he is not a biologist, but an experienced jurist. However, he thinks he is the right person to expose any logical errors and faulty rhetoric in a scientific argument (p. 13). He finds that the evidence for the theory of evolution is all but convincing and that scientists who hold on to it, treat it like a religious dogma. He concludes that the theory only serves to

provide the philosophy of naturalism with a suitable story of creation. When one can explain life without referring to God, it is also possible to completely remove Him from your world view. In short, people use the theory of evolution to support their unbelief. This unbelief immediately explains why there is no room for God within scientific practice.

Vis-à-vis this godless philosophy of naturalism, Johnson puts the world view that starts out from the belief that the world has been designed. He is convinced that science can detect traces of this design in nature. What we need, according to Johnson, is a new kind of science, one that does not frenetically cling to the philosophy of naturalism, but one that wants to recognize and reveal the signs of God's work. What we need is a “supernatural science”. Calling something a “religion” is just a trick to make it not true. Johnson (1991, p. 7) writes:

If we say that naturalistic evolution is science, and supernatural creation is religion, the effect is not very different from saying that the former is true and the latter is fantasy. When the doctrines of science are taught as fact, then whatever those doctrines exclude cannot be true. By the use of labels, objections to naturalistic evolution can be dismissed without a fair hearing.

Johnson wants his readers to believe that he is *not* a creationist in the strict sense of the word. He claims to speak for everyone who believes that God created the world.³ However, there are numerous indications that put Johnson in the tradition of fundamentalist creationism. Reducing evolution to nothing but a type of faith is just one indication. Also, the way in which Johnson casts doubt on the scientific nature of the theory of evolution is derived from young-earth creationist literature. None of his arguments are original: the gaps in the fossil record, homologous characteristics that are allegedly non-discriminative, the distinction between macroevolution and microevolution, the existence of “inexplicable” and therefore divine design, etc. In short, if Intelligent Design wants to be recognized as science (and thus eventually be taught in schools), it needs to offer more than alleged arguments against evolutionary theory. It needs to become a positive, scientific programme (Pennock, 1999).

³ “In the broadest sense, a 'creationist' is simply a person who believes that the World (and especially mankind) was designed, and exists for a purpose.” (Johnson, 1991, p. 113)

2.2.4 The Center for the Renewal of Science and Culture (CRSC)

In 1992, the first steps in the “right” direction were taken. A symposium entitled *Darwinism: Scientific Inference or Philosophical Preference* marks the beginning of Intelligent Design as a movement. Johnson plays a key role at the symposium: he is a speaker at the symposium’s opening, venting his ideas on naturalism and evolutionary theory. Other notable participants, besides philosopher of biology Michael Ruse and zoologist Arthur Shapiro, include Michael Behe, William Dembski and Stephen Meyer (Buell & Hearn, 1994; Forrest & Gross, 2007[2004]; Scott, 2007). Four years later, the latter three names reappear, along with Johnson, when the *Center for the Renewal of Science and Culture* is founded. This centre operates as a subsidiary of the *Discovery Institute*, a conservative think tank in Seattle that was established in 1990 by Bruce Chapman, a former staff member of Ronald Reagan (Forrest & Gross, 2007[2004]). In the centre, Phillip Johnson took on the role of advisor, while Stephen Meyer became president. For the scientific foundations of the Intelligent Design movement, the organization relied on Michael Behe and William Dembski. Both claimed to have discovered irrefutable evidence in support of Intelligent Design.

2.3 Intelligent Design and the 'new science'

2.3.1 Behe’s “Irreducible Complexity”

Michael Behe is a Catholic biochemist at Lehigh University in Bethlehem, a small town in Pennsylvania. He holds a prominent position in the Intelligent Design movement, but at the university he is considered somewhat of an outsider. He accepts that humans and anthropoids have a common ancestor. Unlike many of his creationist supporters, he does not believe in a young earth (Behe, 2006, p. 5, 2007, p. 3). Behe can be considered as the most scientifically respectable supporter of Intelligent Design. He has even published several articles in respected scientific journals. These articles are all strictly related to his field of study and they never mention the notion of Intelligent Design. He only addresses this topic in publications that do not go through the usual academic channels of *peer review*, including his books.

Nevertheless, Behe goes to extraordinary lengths to also give these publications – and thus his views on Intelligent Design – a touch of scientific distinction. His books are full of scientific jargon and are accompanied by an elaborate system of footnotes with

references to scientific publications. As a biochemist, Behe succeeds in fascinating his readers with clear explanations of the coagulation cascade, the immune system etc.. Behe, however, moves beyond orthodox science, when he uses these processes to address examples of what he calls “irreducible complexity”. Here, the scientist in Behe makes way for the natural theologian (see the previous chapter).

Behe introduced the concept in 1992 (Forrest & Gross, 2007[2004]), but only developed it in his book *Darwin's Black Box* in 1996. There, he defines irreducible complexity as follows:

By irreducibly complex I mean a single system composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning. An irreducibly complex system cannot be produced directly (that is, by continuously improving the initial function, which continues to work by the same mechanism) by slight, successive modifications of a precursor system, because any precursor to an irreducibly complex system that is missing a part is by definition non-functional. (Behe, 1996, p. 48)

Behe illustrates this concept using a mousetrap (Behe, 1996, 2001). A mousetrap consists of several parts (the base, the spring, the catch, etc.) and the contribution of each of these parts is necessary for its functioning, which is catching a mouse. Remove one of these parts and the mousetrap will stop working. Therefore, it is impossible for it to have evolved gradually into its current shape (because every precursor would be faulty), which leads Behe to conclude that its existence must clearly be the work of an intelligent designer. A mousetrap did not evolve. According to Behe, the same is true for biochemical processes such as the coagulation cascade and the immune system. Both are processes in which all components need to be present in order to work. One of Behe's favourite examples is the bacterial flagellum. Because of flagella, bacteria are able to manoeuvre their way through their environment in search of food. It consists of some forty-odd components that are all necessary for its functioning. Take one of these components away and the bacterium becomes immobilized. Since any precursor would miss one of these components, it simply cannot work, seeing that there is no function on which natural selection could take place. The flagellum can therefore not be the result of evolution by natural selection. This is why the bacterial flagellum is the archetype of irreducible complexity. According to Behe (1996), it is undeniably the work of an intelligent designer.

Every comparison has its faults, but the analogy between a mousetrap and a flagellum falls short completely. Mousetraps are designed and constructed, piece by piece, using a blueprint. Organisms, however, are involved in reproduction, a process that causes small, random variations to appear in every generation. These variations may be saved and passed on to a next generation. This allows for an organism to

gradually evolve, something mousetraps cannot do (Perakh, 2004b; M. Young, 2004). Also, in nature, many examples exist of *redundant* complexity. This entails that, if one part is lost, the system will not necessarily cease functioning. (Perakh, 2004b; Shanks & Joplin, 1999). Also, Behe's definition of irreducible complexity does not allow that a "precursor system" once performed a different function. However, this is an important evolutionary phenomenon (Gishlick, 2004; K. R. Miller, 1999; Pennock, 1999; Sarkar, 2007; Sober, 2008). A precursor of a flagellum may not work as a small outboard engine, but it does function excellently as a hypodermic needle (Matzke, 2003; K. R. Miller, 1999; Musgrave, 2004). Therefore, it should not be surprising that scientists have succeeded in providing a decent and plausible evolutionary explanation for the flagellum (Matzke, 2003).

Behe has responded to these lines of criticism by arguing that he merely claimed that complex biological systems are irreducible complex if they effectively cease functioning when one part is removed. Indeed, under that definition, many complex biological systems are irreducibly complex. However, in that case, irreducible complexity does not pose a problem to evolutionary theory. Nonetheless, Behe continues to treat irreducible complexity as "an insurmountable obstacle to evolution". (Boudry et al., 2010, p. 477)

To make matter worse, the mousetrap, Behe's prime example of irreducible complexity, was not really that good a choice for him to build his argument on. John H. McDonald, biologist at the University of Delaware, illustrated this by removing several pieces of a mousetrap. According to Behe's definition of irreducible complexity, the mousetrap would no longer function. Even if the mousetrap consists of six, five, four, three or two parts, it is actually still able to catch mice (albeit less efficiently than the original version). Even a mousetrap made from just one part can still work: uncoil the two ends of the spring, bend one end up and attach the other end on this end and put a bit of cheese in between. When the mouse touches the cheese, the upper end of the spring will be released. The mouse is trapped (McDonald, 2002, n.d.). A mousetrap does not appear to be that irreducibly complex.

Moreover, Behe's arguments can be compared with pre-Darwinian proofs for the existence of God. Natural theologians, such as William Paley, from the eighteenth and early nineteenth century compared regular complex biological phenomena with human artefacts. Darwin's theory of evolution ended these comparisons (Darwin, 1859; Dawkins, 2006 [1986]). Behe is also clearly indebted to the young-earth creationists when he came up with the term 'irreducible complexity'. Ariel Roth (1980) already wrote about "complex integrated biochemical systems" in the early 1980s. Finally, irreducible complexity within information theory does not point to design; it is a term that actually seems to support the notion of chance (Perakh, 2004b, pp. 126-129). Despite these serious problems, Behe (2006) is convinced that history will consider the discovery of design – using his irreducible complexity – to be on par with the

discoveries of Newton, Einstein, Lavoisier, Schrödinger, Pasteur and Darwin. However, very few scientists share his enthusiasm.

2.3.2 Dembski's "Specified Complexity"

William Dembski is someone who does take Behe seriously. He is the second proponent of Intelligent Design with sound academic credentials. He holds two PhDs, one in Mathematics and one in Philosophy, and he also completed a Master of Divinity in theology (Forrest & Gross, 2007[2004]). According to Dembski, there are certain patterns in nature that cannot be explained by "mere chance". These are examples of what he calls *specified complexity* or *Complex Specified Information (CSI)* (Dembski, 1998). Behe's irreducible complexity provides an excellent illustration of this (Dembski, 1999, 2004; Dembski & Wells, 2008).

As with "irreducible complexity", the term "specified complexity" did not fall from the sky. The term makes its first appearance in the book *The Origins of Life* (1973) by British chemist – and certainly not a creationist – Leslie Olsen, who studies the origin of life. Olsen uses the concept to distinguish life from not-life (Dembski, 2004, p. 81; Dembski & Wells, 2008, p. 168). Some ten years later, in the book *The Mystery of Life's Origin* (1984, p. 145), creationists Thaxton, Bradley and Roger Olsen assert that specified complexity provides a better explanation for the origins of life than natural explanations do. Dembski continues on the same course and turns specified complexity into *the* criterion for intelligent design (Dembski, 1998, 1999, 2004).

What is specified complexity according to Dembski? The term consists of two concepts: specification and complexity. For Dembski, complexity is nothing more than a synonym for improbability (Dembski, 1999, p. 130). Suppose you toss a coin a hundred times. The resulting sequence will be highly improbable. That is why, according to Dembski, we can call this sequence complex. However, complexity alone is not enough to discover intelligent design. This complex sequence was the result of pure chance. That is why complexity also has to be specified. This means that the complex phenomenon has to display an independent pattern. Compare these randomly typed letters *kduegrvsgaiznxdysbziç* with *methinksitislikeaweasel*. Both sequences are complex (highly improbable), but only the latter reveals a pattern. They form a meaningful sentence, in this case a sentence from William Shakespeare's *Hamlet*. This makes the sequence specified, which in turn makes it a clear example of intelligent design (Dembski, 1998, 1999, 2004; Dembski & Wells, 2008).

Dembski claims that his notion of specified complexity can be used as an *explanatory filter*. This filter acts as some kind of algorithm. Every time you want to explain a phenomenon, you ask three simple questions. Firstly, is the phenomenon contingent? If it is not contingent, then it is necessary, which means that the phenomenon can be

explained by the laws of nature. Secondly, is it complex? If it is not, then it is more likely to be explained by chance. Thirdly, is it specified? If it is not, you can again invoke chance as an explanation. Only when the response to these three questions is 'yes', then one can safely conclude to be dealing with an instance of *design* (Dembski, 1999, p. 133).

Dembski eagerly uses mathematical formulas and symbols to support his claims. Doing this, he gives the impression to be writing about serious and complicated matters. When it comes to the content, however, his math brings very little added value. His ideas can equally well be phrased without his formulas (Perakh, 2004b, p. 27). Only then is it revealed how problematic Dembski's criterion for design is. Several experts have addressed this issue and they discovered a number of shortcomings. Firstly, Dembski's filter does not leave any opening for the existence of natural selection. He immediately jumps from chance to design, whereas natural selection is a game of chance – the mutations are random – *and* necessity – the environment determines the outcome. Dembski, however, equates natural selection with mere chance. However, natural selection and chance are not one and the same. Let a computer generate a set of 23 letters. The odds that the sentence METHINKSITISLIKEAWEASEL coincidentally appears are minimal (i.e. $1/26^{23}$). However, by allowing the computer to save a correct letter, only 598 steps are needed to arrive at this result. Chance and selection are not the same as chance alone (Dawkins, 2006 [1986]). Hence, natural selection is a priori undetectable with this filter (Edis, 2004; Forrest & Gross, 2007[2004]; Perakh, 2004b). Secondly, Dembski's explanatory filter proves to be much too simple. Pennock (1999, p. 95) indicates that Dembski's three allowed possibilities, namely necessity, coincidence and design, are not mutually exclusive. It is perfectly possible that a phenomenon can be explained using both design and a law of nature, or design and coincidence. Moreover, not all laws are deterministic or necessary. Some only speak of probabilities. Thirdly, it is not very clear how we can recognize a certain pattern independently. Imagine we receive a message from outer space with the letters PAIN. English speakers would immediately want to help out while the French would start baking lots of intergalactic bread. So in order to recognize a pattern, one inevitably has to fall back on other beliefs. It is not clear how Dembski can determine such a pattern independently, i.e. without a “carrier” (Pennock, 1999, p. 253; Perakh, 2004a, p. 156).

On the back cover of Dembski's book, *Intelligent Design* (1999), Rob Koons of the CSC, calls Dembski the Isaac Newton of information theory. However, Dembski's ideas, as is the case with Behe's, remain largely ignored by scientists. Scientists that do consider the theories by Behe, Dembski and other ID proponents, constantly reveal serious shortcomings, which explain why they consistently refuse to accept Intelligent Design as a science.

2.3.3 Supernatural or theistic science

ID proponents do not tend to blame this scientific debacle on their inadequate theories. Instead, they point the finger at the scientific community that rejects their ideas. They consider evolutionary scientists to have a dogmatic mindset, which is supposed to explain why these scientists are unable to accept any explanation that involves intelligent design. According to adherents of Intelligent Design, they are blinded by their belief in the philosophy of *naturalism*, a worldview that leads them to deny every form of divine design a priori. If scientists would allow themselves to see the hand of God in their science, then it would immediately become clear to them that what seems to be designed has actually *been* designed. This attitude can be found in practically every publication supporting Intelligent Design. The film *Expelled. No intelligence allowed* (2008), featuring the American comedian Ben Stein, shares this point of view. It presents the “scientists” of Intelligent Design as revolutionary, open-minded innovators who have to compete against a Darwinian establishment. Scientists defend themselves against these accusations by stating that the naturalism of science is merely the result of a methodological choice. Science simply looks for natural explanations for natural phenomena. According to Intelligent Design adherents, that is where the shoe pinches. To discover design, a new kind of science is needed that includes a method that allows for supernatural explanations. That is why Intelligent Design is striving for a supernatural or a theistic science.

Phillip Johnson is the main advocate of this position. He calls the theory of evolution an atheist creation myth with hardly any scientific legitimacy. The only reason why Darwinism is still around, is because of its consistent exclusion of *design* (Johnson, 1991, 2001). He believes that creation or intelligent design would offer a much better explanation for many different phenomena. We only need to adjust our ideas about science:

There are no scientific points in favor of creation and there never will be any as long as naturalists control the definition of science, because creationist explanations by definition violate the fundamental commitment of science to naturalism. (Johnson, 2001, p. 67)

Johnson's ideas are also supported by conservative Protestant theologian Alvin Plantinga. He too is convinced that God's absence in science reflects a philosophical presumption. That is why Plantinga (2001, p. 139) pleads for a theistic science, a science without naturalistic limitations:

If such a restriction is part of the very essence of science, then what we need here, of course, is not natural science, but a broader inquiry that can include all that we know, including the truths that God has created life on earth and could have done it in many different ways. 'Unnatural science', 'Creation Science', 'Theistic Science' – call it what you will. (...) What we need is a scientific account of life that isn't restricted by methodological naturalism.

To retort these claims, Pennock (1999) argues that by allowing supernatural explanations in science, scientific practice itself is inherently threatened. According to him, this would be an immediate consequence of a supernatural or theistic science. Every time you are confronted with an insoluble problem, you just play the God card and stop looking. As such, with *Intelligent Design*, Behe and his supporters have found the perfect way to save themselves a lot of work (Pennock, 1999, p. 271). Hence, it should not come as a surprise that the “scientific project” of ID has not delivered any results. However, although Intelligent Design by itself might be rightly considered to be a science stopper, it is by no means obvious that this argument applies to all supernatural explanations. Instead of claiming that evidence for the supernatural is impossible without impinging on the explanatory power of science, one could argue that science simply has not found any evidence in support of supernatural design, making the demand for a theistic science entirely superfluous (Boudry, et al., 2010a). This is not only the case in the biological sciences. Also in physics and cognitive science, scientists have not come across any phenomena that require a supernatural or theistic explanation (Edis, 2008).

2.4 Intelligent Design and the New Culture

2.4.1 The Wedge

One might assume that adherents of Intelligent Design would be somewhat down in the dumps because of the scientific failure of their theory. In fact, the opposite is true. They strongly believe that they are on the right track. To a broad, religious audience, they manage to give the impression of having a fully scientific alternative to “Darwinism”. They do not accomplish this by publishing articles in renowned scientific journals – which is what scientists usually do when they come up with truly innovating ideas – but by trying to influence public opinion through several different channels: books, websites, congresses, radio, television, films, etc. They thereby not only show of their

diplomas and scientific sounding theories, but they also appeal to the strong democratic sentiments of the average American. It is not *fair* that nobody from the scientific establishment gives Intelligent Design a chance, is it? In disputes, both parties deserve to be heard, don't they? Is there no freedom any more in the United States since ideas can be so easily suppressed? Using this strategy, adherents of Intelligent Design seek the support of the public for their plans of having intelligent design taught in the biology classes.

This tactic is part of a larger strategy, commonly known as *The Wedge*. *The Wedge* takes its name from a document that was leaked on the Internet in 1999. *The Wedge* reads like an action plan describing the short and long term plans of the *Center for the Renewal of Science and Culture*. According to these plans, all efforts must contribute to “defeating scientific materialism and its destructive moral, cultural and political legacies” (Discovery Institute, 1999). Intelligent Design is supposed to act as a wedge to crack open scientific materialism. Once this succeeds, design theory will finally “permeate religious, cultural, moral and political life” (Discovery Institute, 1999). In short, *The Wedge* intends to be much more than a new kind of science. It strives for an entirely new society.

2.4.2 Phillip Johnson and 'modernism'

In *The Wedge*, Phillip Johnson's books, *Darwin on Trial* (1991), *Reason in the Balance* (1995) and *Defeating Darwinism by Opening Minds* (1997a) are called 'the thin edge'. In these books, Johnson fulminates not only against scientific naturalism or materialism, but also against what he calls *modernism* (Johnson, 1995, 1997a). He describes it as the intellectual condition that begins “when people realize that God is really dead and that humankind is therefore on its own” (Johnson, 1995, p. 37). Johnson labels modernism the established religious philosophy. This not only means that science excludes God, but also that God is excluded from society. Modernism is therefore responsible for the secularism that proclaims God to be unconstitutional (Johnson, 1995, 1996a, 1996b). This removal of God from society has far-reaching consequences for man and his culture. Phenomena like feminism, humanism, euthanasia, abortion, therapeutic cloning, homosexuality, premarital sex, divorce, drug abuse, sexual education and paedophilia only arise when man thinks he is able to live without God (Johnson, 1995; see also Wiker, 2002).

Only when man recognizes that God has designed certain natural phenomena will he be able to discover that this world has been created according to a plan. From the way in which God has created the world, we can learn to understand what He intended to do with creation. For instance, if God created man and woman, He did not do so without reason: being men and women, we have to unite, make babies and take care of them. All

other types of living together or other forms of sexuality breach God's law, thus making them sinful. This will not only change sexual morality, it also requires a change in our legal system. If we want to follow God's laws of nature, then we should implement them into our legal system. Upholding laws that do not take God's existence into account (e.g. pro-abortion laws) would be irrational; it would even be downright immoral (Johnson, 1995, 1996a, 1996b, 1997b).

2.4.3 Natural law: the road to theocracy

The idea of a divine natural law makes the concept of 'rights' redundant. Just like the creationists from the sixties and seventies of the previous century, adherents of Intelligent Design do not speak in terms of women's rights, abortion rights, gay marriage rights, etc. According to them, these are merely subjective human inventions that mean little to nothing when compared with the objective, absolute truth of God's morality. Benjamin Wiker (2002), a fellow of the *Discovery Institute*, postulates that for all contemporary moral conflicts that disturb our culture today, we must realize that appealing to our rights does not offer any resolution to resolve any of these conflicts. The notion of modern rights solely belongs to the universe of the materialist. According to the rivalling vision of natural law, what is good has already been determined a long time ago and modern rights only have their roots in an amoral outlook on the universe (Wiker, 2002, p. 315).

Adherents of Intelligent Design may appeal to democratic terms as “academic freedom” and “fairness”, but they do not show themselves to be strong supporters of any kind of open society. When Johnson claims that God's natural law has to be at the heart of a society's legal system, then he is proposing to end the secular state that guarantees the separation of church and state. It is nothing more and nothing less than a plea for a theocracy. Not only women and homosexuals will suffer the consequences, people of others faiths will as well (Forrest, 2007; Forrest & Gross, 2005). Of course the *Discovery Institute* refutes the accusations that it wants to establish a theocracy (Discovery Institute, 2005). After all, this would deter many Americans. However, this denial is as convincing as their claim that Intelligent Design is a real science. Barbara Forrest and Paul Gross (2005, 2007[2004]) have convincingly demonstrated that the people involved with the *Discovery Institute* are closely related to Christian organisations that aim to implement the moral laws of the Old Testament into the American judicial system.

2.5 Dover, 2005

The concept of Intelligent Design was established in 1988, a year after the American Supreme Court had declared the introduction of so-called “scientific creationism” in public schools unconstitutional. Maybe Intelligent Design could circumvent the separation between church and state and be presented as a 'scientific' alternative to the theory of evolution in biology lessons. In 2005, Intelligent Design was put to the test when its scientific character became the subject of a lawsuit: *Kitzmiller vs. Dover Area School District in Dover*. Would the judge accept Intelligent Design?

The lawsuit was initiated after creationist members of the Dover area school board started to ask questions about the biology textbook the students were using. One of them said that the book was “laced with Darwinism”. In the United States, school boards decide which textbooks the students will use, and this particular textbook was one of the most popular ones for biology across the entire United States. In the end, the Dover school board decided that biology teachers had to read out a text to students in which it was made clear that the theory of evolution was “only a theory” and “not a fact”. The text also mentioned the existence of Intelligent Design as an alternative explanation for the origin of life. In order to “keep an open mind”, students could consult *Of Pandas and People* in the school library (Forrest & Gross, 2007[2004], p. 325; Numbers, 2006, pp. 391-392). The teachers however refused to read the text, which meant an administrator had to do it instead. After this, eleven parents, including Tammy Kitzmiller, with the support of the *American Civil Liberties Union* (ACLU), filed a complaint. A trial had become inevitable.

For the Intelligent Design proponents, the trial turned out to be a total fiasco. Judge John E. Jones III described the school board's initiative as an example of “breath-taking inanity”. He also judged that Intelligent Design was a form of religion, which meant that it should not be taught in biology lessons. Having the school board's text read aloud violated the constitutional separation of church and state (Forrest & Gross, 2007[2004]; Numbers, 2006; Scott, 2007). Intelligent Design could therefore no longer be used as a cover to smuggle creationism into the biology classes of public schools. Today, adherents of Intelligent Design call upon schools to discuss “the evidence for and against evolutionary theory” or to expose its “strengths and weaknesses” by means of “critical analysis”. In 2009, bills had been put forward in New Mexico⁴, Iowa⁵ and

⁴ Part of the New Mexico bill runs as follows: 'The department, school district governing authorities and school administrators shall not prohibit any teacher, when biological evolution or chemical evolution is being taught in accordance with adopted standards and curricula, from informing students about relevant scientific

Oklahoma⁶ to support this new strategy. And since 2008, the Louisiana Science Education Act stipulates that

the State Board of Elementary and Secondary Education, upon request of a city, parish, or other local public school board, shall allow and assist teachers, principals and other school administrators to create and foster an environment within public elementary and secondary schools that promotes critical thinking skills, logical analysis, and open and objective discussion of scientific theories being studied including, but not limited to, evolution, the origins of life, global warming, and human cloning.

The Wedge is still at work.

2.6 Conclusion

The lecturer from the introduction called Intelligent Design “a strongly nuanced version of creationism”.⁷ However, he is mistaken: it is not a nuanced, but a slightly mutated form of creationism. Granted, Intelligent Design does not depend on a literalist reading of the book of Genesis. However, not only are there strong historical connections between Intelligent Design and “scientific creationism”, but the arguments the Intelligent Design proponents formulate against what they call “Darwinism”, have all been adopted from creationist literature. Furthermore, Intelligent Design, along with

information regarding either *the scientific strengths or scientific weaknesses* pertaining to biological evolution or chemical evolution.’ (Senate Bill 433, 2009)[my italics]

⁵ Part of the Iowa bill runs as follows: ‘It is therefore the intent of the general assembly that this Act be construed to expressly protect the affirmative right and freedom of every instructor at the elementary, secondary, and postsecondary level to objectively present scientific information relevant to *the full range of scientific views* regarding biological and chemical evolution in connection with teaching any prescribed curriculum regarding chemical or biological evolution.’ (House File 183, 2009) [my italics]

⁶ Part of the Oklahoma bill runs as follows: ‘The Oklahoma Legislature finds that an important purpose of science education is to inform students about *scientific evidence* and to help students develop *critical thinking skills* they need in order to become intelligent, productive, and scientifically informed citizens. The Legislature further finds that the teaching of some scientific subjects, such as *biological evolution, the chemical origins of life, global warming, and human cloning*, can cause controversy, and that some teachers may be unsure of the expectations concerning how they should present information on such subjects.’(Senate Bill 320, 2009) [my italics]

⁷ “Darwin zegt niets over zingeving”, *Artevelde Magazine*, 29, January 2009.

young-earth creationism, is propagated by a conservative religious movement with its own political agenda. It is clear that putting forward Intelligent Design as an “alternative” for evolutionary theory is strongly misleading in many respects.

Chapter 3

Creationism in Europe. Facts, gaps and prospects¹

Abstract

The purpose of the paper is threefold. First, we present and discuss the already extant literature on creationism in Europe (the ‘facts’). Within this section, we offer a review of the literature as well as an overview of the most remarkable developments and events recorded therein. Second, we indicate which material is missing from the literature (the ‘gaps’) and signal which blanks we think should be filled in first. And, third, we sketch the most promising routes the research can take (the ‘prospects’), not only with the goal of furthering our understanding of creationism in Europe, but also with an eye on the important contributions such an improved understanding could make to other established research domains.

¹ This chapter is currently under review with *Religion* (Blancke, et al., submitted).

3.1 Introduction

Creationism, in the sense of religiously inspired activist antievolutionism, has since long been considered a typical instance of American extravaganza, not to be found anywhere else. Often quoted, to illustrate this stance, are the American scientists, the late Stephen J. Gould, who, in an interview in 2000, labelled creationism as a ‘local, indigenous, American bizarritty’ and Richard C. Lewontin, who wrote in the introduction to *Scientists confront creationism* in 1983 that ‘creationism in an American institution, and it is not only American but specifically southern and southwestern’ (both in Numbers, 2009, p. 215). However, although the popularity of creationism has indeed reached unparalleled heights in the United States, historical and sociological research over the last two decades has decisively shown that creationism has broken from its original theological and geographical confines and is now indeed a global issue. Creationist activities have been reported from Canada to Korea, from Brazil to Australia (Numbers, 2006, 2009). In Europe as well there has been an increase of creationist activities. As a result a growing number of European scholars, including the authors of this paper, have taken a serious interest in the subject. The material available is scattered geographically and often tied in local languages making it difficult to get an overview of the studies of creationism in Europe. A review of the literature is thus much needed.

The purpose of the paper is threefold. First, we will present and discuss the already extant literature on creationism in Europe (the ‘facts’). Within this section, we will offer a review of the literature as well as an overview of the most remarkable developments and events recorded therein. Secondly, we will indicate which material is missing from the literature (the ‘gaps’) and signal which blanks we think should be filled in first. And, thirdly, we will sketch the most promising routes the research can take (the ‘prospects’), not only with the goal of furthering our understanding of creationism in Europe, but also with an eye on the important contributions such an improved understanding could make to other established research areas such as the study of cultural evolution and the study of the relation between science and religion.

3.2 The facts

Szerszynski discerns three types of studies involving creationism (2010, pp. 155-160): The first type ‘consists of mainly historical studies of the individuals and organizations

that have been actively promoting creationist ideas over the last hundred years' (pp. 155-156). The second type 'consists of quantitative studies, most common in America but also carried out elsewhere, which try to determine the distribution in different national populations of ideas about the origin and development of life, and of human beings in particular' (p. 157). The third type concerns 'attempts to understand *why* people believe in evolution or creationism' (p. 159, his italics). We find a similar pattern in the literature on creationism in Europe and are therefore adopting Szerszynski's typology for the present purpose.

3.2.1 Historical studies

In the United States the bulk of historical literature discusses the origins of and developments within American creationism. Ronald Numbers' seminal *The Creationists. From Scientific Creationism to Intelligent Design* (2006) traces the historical roots of creationism to the second half of the 19th century. The situation is different when it comes to historical studies of European creationism. With a few exceptions such as Abraham C. Flipse's study (in press-b) of the origin of Dutch creationism and a study of antievolutionism in the Islamic world, including Turkey, by Martin Riexinger (2010), there are no studies available that explicitly treat the history of European creationism before the 1970s. This does not mean that antievolution sentiments and movements were absent in Europe. Scandinavian protestants, for example, were challenging the theory of evolution in the early decades of the twentieth century (Hjermitslev, 2011). In Britain the anthropologist Sir Arthur Keith was warning against a rise of creationism in the 1920s and in London in 1932 the Evolution Protest Movement was founded, allegedly as the first of its kind in the world, with Sir Ambrose Fleming as its first president (Numbers, 2006, pp. 141-144). Generally, historical studies have dealt very little with the lives of actors or the history of organizations involved with creationist activism, but instead offer rather brief overviews of people, organizations and most significant events involving European creationism in the last ten to fifteen years. These studies include Kutschera (2003), Graebisch and Schiermeier (2006), Cornish-Bowden and Cárdenas (2007), Kjærgaard (2008) and Numbers (2006, 2009, 2011). An interesting overview of creationist events per country can also be found in the working document proceeding the Council of Europe resolution 1580 (Committee on Culture, 2007) that warned against 'the dangers of creationism for education' in October 2007 (Parliamentary Assembly of the Council of Europe, 2007). Creationism in Turkey was already being discussed at length in the 1990s (Edis, 1994, 1999, 2007; Hameed, 2010; Riexinger, 2008; Sayin & Kence, 1999), as was creationism in the UK (Coleman & Carlin, 1996). However, recently more detailed studies have become available discussing creationism in Germany (Kutschera, 2008a, 2008b), the United Kingdom (Williams, 2008), Russia (I. Levit, et al.,

2007), Poland (Borczyk, 2010), Denmark (Hjerimitslev, 2010a) and the Netherlands (Blancke, 2010; Flipse, in press-b).

In terms of main actors, organizations and events there is a certain overlap in the literature on creationism in Europe. As some of them have become standard references in public and scholarly discussions of the issue, it would be useful to briefly recount some of the more recent episodes. For instance, by the beginning of 2002, newspapers reported that Emmanuel College, an independent school in Gateshead, England, had rented out its facilities to the organizers of a creationist conference featuring Ken Ham, the president of the largest young-earth creationist organization, *Answers in Genesis*. However, following this minor event a newspaper reported that at Emmanuel College creationism was taught as an alternative to evolutionary theory. Although the Emmanuel Schools Foundation sponsoring the school denied these accusations, at least two of the school's staff, the Head of Science and the First Principal, were well-known young-earthers and proponents of an equal time policy (one of them actually admitted that he preferred the exclusive teaching of creationism, but said he would settle for equal time). When MPs asked questions about the teaching of creationism in (partly) state-funded schools to Prime Minister Tony Blair, he responded by referring to the outstanding results of the school, said that the reports of creationism were exaggerated and claimed that education benefits from diversity (Cornish-Bowden & Càrdenas, 2007; Gross, 2002; Kutschera, 2003; Numbers, 2006; Williams, 2008). Another important creationist event in the UK occurred in 2006, when the recently founded creationist pressure group *Truth in Science* had two DVDs promoting intelligent design distributed to every secondary school in the UK. In immediate response the Ministry of Education claimed that it did not endorse the use of such material in science classes. In response, the British Centre for Science Education was founded to monitor creationist activities in the UK in order to meet creationist activities with a speedy and apt response (Graebisch & Schiermeier, 2006; Williams, 2008).

In Germany, a somewhat similar incident occurred when in 2006 it was reported that creationism was taught at two schools in Giesen, a town in the state of Hesse. However, instead of explicitly condemning such educational practices as happened in the UK, the Minister of Education of the state, Karin Wolff, sided with the schools in opining that creationism should be taught along with evolutionary theory in biology classes. (Cornish-Bowden & Càrdenas, 2007; Graebisch & Schiermeier, 2006) Also in Germany, the creationist organization *Wort und Wissen* (Word and Knowledge), published a creationist biology textbook with the title *Evolution. Ein kritisches Lehrbuch* (Evolution. A critical textbook), written by theologian Reinhard Junker and microbiologist Siegfried Sherer. The book has been translated into several European languages including Portuguese, Finnish, Russian and Dutch, was awarded with a German textbook prize (which was sponsored by religious conservatives), and is used in at least some German public schools as a supplement to the authorized textbooks (Kutschera, 2003, 2008b; Numbers,

2006). In Russia, just like in almost every other eastern European country, creationists have seized the opportunities that arose after the fall of communism in 1989. American creationists soon exported their beliefs to the region, but some events reveal a more indigenous form of creationism. In 2006, a fifteen year old girl and her parents filed a complaint to the court in St Petersburg, demanding freedom of choice as her religious beliefs were violated by the teaching of evolutionary theory. This action was supported by both the Russian Orthodox Church and the Russian Minister of Education who claimed to welcome the teaching of alternative ideas. In February 2007, however, the case was turned down (G. S. Levit, et al., 2006; I. Levit, et al., 2007). In Scandinavia organised creationist movements did not appear before the 1980s when creationist groups and individuals in Sweden, Norway and Denmark began to cooperate. In 1983 evangelical antievolutionists from Norway and Denmark launched the journal *Origo* and since then Scandinavian creationist groups to the right of the Protestant theological spectrum have joined forces in translating books, organising networks and conferences and building up websites such as skabelse.dk and genesis.nu. In 1996 a creationist museum was established in Umeå, Sweden, and in 2009, the Darwin anniversary year, Norwegian and Danish antievolutionists generated some media attention by registering polemic anti-Darwinian websites. During the last few years, Muslim old-earth creationists and Vedic intelligent design advocates have also entered the Scandinavian scene through websites, lectures, media appearances and publications (Hjermitslev, 2010a, 2010b; Kjærgaard, 2010).

These episodes indicate that creationism in Europe is a phenomenon to be reckoned with. What is particularly remarkable is the fact that many of the incidents involve ministers who not only condone creationist teaching, but also actively support it. Tony Blair, a devoted Catholic, has always refrained from speaking forcefully against the teaching of creationism (Williams, 2008), and in Hesse, the minister of education expressed her sympathy with the creationist call for equal time. In the Netherlands, the Minister of Education, Science and Culture, Maria van der Hoeven, a Catholic member of the Christian democratic party CDA, suggested that intelligent design could be 'applied in schools and classes' (translated quote in Blancke, 2010, p. 793). In some countries, however, the political backup went much further. In Italy, in 2004, for instance, the minister of education and research in the Berlusconi government, Letizia Moratti, planned the removal of evolutionary theory from education for 11 to 14 year olds (Graebisch & Schiermeier, 2006; Numbers, 2006). In 2005, the Romanian ministry of education allowed teachers in both public and Christian schools to opt for a creationist alternative to the biology textbook (Numbers, 2006). In Serbia, the minister of education, Ljiljana Colic, had to resign after she had declared in 2005 that educators should not teach evolutionary theory if creationism was not also included (Committee on Culture, 2007; Numbers, 2006). In both Russia and Ukraine, the ministry of education cosponsored creationist conferences (Numbers, 2006) and in Poland, the deputy

minister of education, the ultra-Catholic Mirosław Orzechowski, professed in 2006 that '[t]he theory of evolution is a lie. It is an error we have legalized as a common truth'. He also considered evolution to be the 'feeble idea of an aged non-believer' and claimed that Darwin was 'a vegetarian and lacked fire inside him' (quoted in Kjærgaard, 2008, p. 40). These events clearly demonstrate that although creationist activism is not as manifest in the public sphere as in the United States, creationist groups, at least in some of the European countries, are able to exert (or even gain) sufficient power to influence national educational policy.

Even at a more general European level creationist lobbying is now part of the political reality. At a conference in Germany in 2009 the reporter of the Committee on Culture, Science and Education, Anne Brasseur, said that the decision over the resolution that warns against the dangers of creationism came to a surprisingly close vote after intense lobbying by the Vatican and the European Evangelical Alliance (Curry, 2009; Hjermitsev, 2010a). In October 2006, a seminar was held in Brussels for the members of the European Parliament, entitled *Teaching evolutionary theory in Europe. Is your child being indoctrinated in the classroom?* The seminar was organized by the Polish Catholic creationist Maciej Giertych and featured three antievolutionists (Kutschera, 2006).

However, the closest European collaboration between state and creationist groups took place in Turkey, where in 1985 the government contacted the young-earth creationist Institute for Creationist Research (ICR) with the request for educational material. Books of prominent ICR members, including Henry Morris' *Scientific Creationism*, were translated into Turkish (with the omission of explicit Biblical references) and distributed for free to every secondary school teacher in the country. Moreover, the most religiously controversial aspects of evolutionary theory, the simian origin of man and the mechanism of natural selection, were deleted from biological textbooks. In the 1990s, conservative politicians with creationist sympathies lost momentum. Under a social democratic government biology textbooks were revised, although they still offered creationist views as an alternative theory. Today, the way creationism and evolution are treated in textbooks very much depend on the kind of government that happens to be in power. In 2002, the moderately Islamic Motherland Party came into power and soon began promoting a version of Muslim old-earth creationism disseminated by Adnan Oktar and his followers from the Science Research Foundation (BAV). Oktar, an interior designer and best known under his pen name Harun Yahya, has also borrowed a lot of material from ICR with which the BAV actively sought cooperation (Edis, 2007; Riexinger, 2010, p. 495). Edis (2007, p. 128) succinctly describes Yahya's creationism as a

grab bag of classic Islamic objections to evolution, arguments copied directly from Christian young-earth creationists and intelligent design proponents, and other

snippets from Western writers who claim to find signs of God in some area or other of modern science.

However, Oktar has managed to repackage the Protestant creationist content into an attractively modern version of Islamic creationism, targeted at urban professionals who wish to reconnect with their Islamic roots. By promoting his message by means of glossy books and slick magazines, DVDs and in particular the internet (Kjærgaard, 2008; Riexinger, 2008), using modern Turkish language (without any Arabic elements), and endorsing modern lifestyle, Oktar is clearly looking for support beyond the old creationist constituency of religious conservatives (Edis, 2007). Remarkably, his activities have not been confined to Turkey. The books of Harun Yahya have been translated in a number of European (but also other) languages including English, French, German, Danish, Russian, Italian, Spanish, Serbo-Croat, Polish, Albanian, Estonian, and Bulgarian. His teachings are particularly attractive to Islamic youngsters who live in West-European cities. Many indulge in a modern Western lifestyle while objecting to Western morals as secular, materialistic and individualistic. To them, Oktar's organization offers the perfect deal. Oktar and his group have been particularly good at drawing media attention. In the course of 2006 and 2007, universities, secondary schools, journalists, clergymen, politicians and scientists in countries like France, Belgium, Spain, Denmark, Switzerland and the UK were sent unrequested copies of the first and second volume of the *Atlas of Creation*, an almost 800-page lavishly produced publication in which evolutionary theory is 'exposed' as a hoax and a dangerous doctrine that inspired the terrorists of 9/11 and a host of other evil things. In addition, in at least France, Germany and Denmark Oktar affiliates have been active in manipulating online web polls on evolution and creationism in order to make it look like the European public has rejected evolutionary theory after reading the *Atlas of Creation*. Therefore, it comes as no surprise that the European Council Committee for Culture, Science and Education devoted special attention to Oktar's efforts when preparing the working documents which would eventually result in resolution 1580 (Committee on Culture, 2007; Kjærgaard, 2008, 2010).

As we have seen, Islamic creationism is not the only kind of antievolutionism that Europe has been confronted with. The Protestant variant has proved particularly popular among evangelicals and in orthodox reformed communities in the UK, the Netherlands, Germany and Switzerland, counting some of the most active creationists among its members. There have also been important incidents inspired by Catholic creationism in Poland, France and Italy, and by Orthodox creationism in Russia and Serbia. Although much of these creationist actions have come out as the result of proselytizing efforts by the large American young-earth organizations ICR and AiG, there is a considerable proportion of 'native' or 'local' creationism, which American-style creationism is sometimes able to exploit, but not always, or at least, not entirely. In

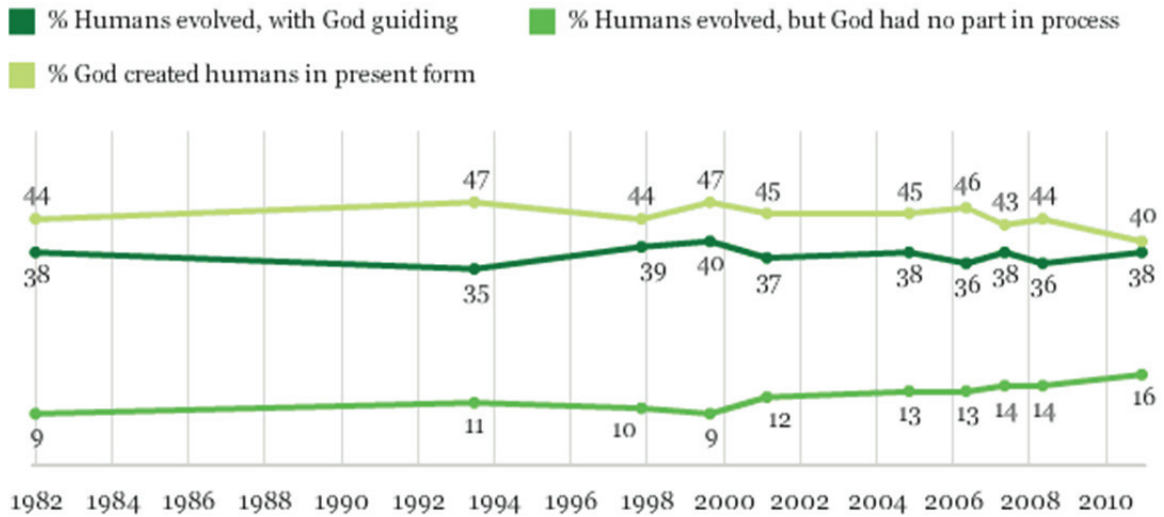
effect, the young-earth creationism and flood geology proclaimed by the Americans, is almost never accepted wholesale, but adjusted and adapted to local needs. For instance, with no First Amendment by which the teaching of biblical creationism is prohibited, European creationists often find it superfluous to guise their beliefs as creation science. The capacity to adapt to local religious and social environments might be considered one of the strengths of creationism. However, not every soil has proven to be equally fertile. In the Netherlands, intelligent design creationism had wedged itself in the subculture of the orthodox reformed and evangelicals rather than in secularist society, the function for which it was intended by American ID proponents (Blancke, 2010; Forrest & Gross, 2007[2004]). Sometimes, local creationists select only bits and pieces that serve their particular local strategies, and in some heavily secularized countries, for instance Belgium (Blancke, 2009c) or Denmark (Hjerimitslev, 2010b), creationists, local or imported, have limited success, resulting in large differences between countries in the frequency and intensity of creationist activism.

3.2.2 Quantitative studies

In the United States, every two year Gallup questions Americans about their belief on the origin of the human species by having them answering the following question: ‘Which of the following statements comes closest to your views on the origin and development of the human species?’ [See Figure 2].

Which of the following statements comes closest to your views on the origin and development of human beings?

1) Human beings have developed over millions of years from less advanced forms of life, but God guided this process, 2) Human beings have developed over millions of years from less advanced forms of life, but God had no part in this process, 3) God created human beings pretty much in their present form at one time within the last 10,000 years or so



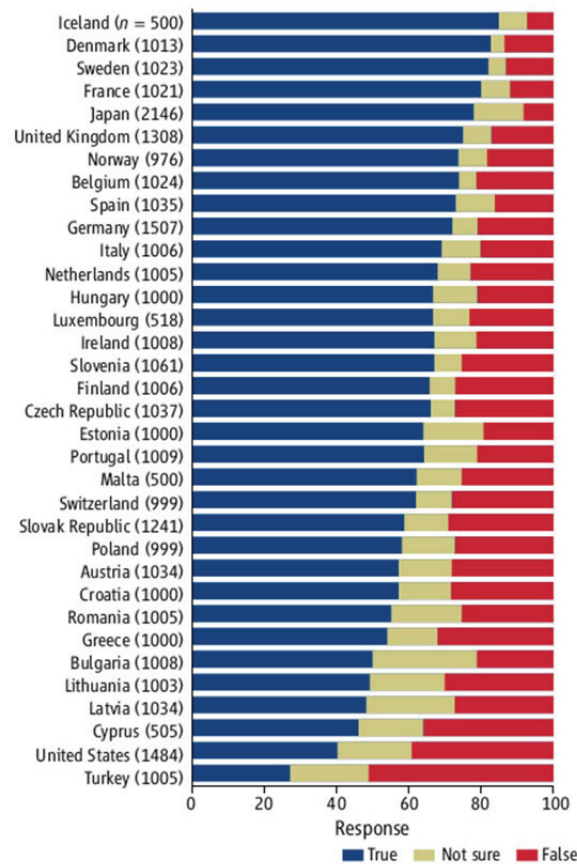
GALLUP

Figure 2 American views on human origins

Figure 2 clearly shows that during almost thirty years figures have been relatively stable, with consistently more than 40% of Americans supporting strict creationism, a little less than 40% believing God guided human evolution and 10 to 15% accepting ‘secular evolution’. In recent years there has been a small increase for the last category whereas strict creationism is slightly declining.

In Europe, such quantitative studies repeated over longer periods of time have not been conducted yet (see the gaps section). However, there is sufficient material available to attain at least a basic idea of the popularity and distribution of creationism in Europe. For instance, Miller *et al* (2006) compared the results from surveys in the United States with two surveys taken in Europe and one in Japan, in which participants were asked whether they considered the statement, ‘Human beings, as we know them, developed from earlier species of animals’ true or false. The results of this study, presented in a diagram (figure 3), clearly indicate that human evolution is more readily accepted in European countries than in the United States, with the exception of Turkey (see below). However, it is often overlooked that even in the most evolution-friendly European states, the level of acceptance almost never raises above 80% and that at least 10% of the population denies the fact of human evolution. In fact, in most countries, no more than 70% accept human evolution, whereas 20% rejects it. Although these figures

are not so dramatic when compared to the situation in the US, they do reveal that antievolutionism is far from absent in Europe.



Public acceptance of evolution in 34 countries, 2005.

Figure 3 “Human beings, as we know them, developed from earlier species of animals.” True or false? (Miller et al. 2006)

Part of the Miller study was based on data collected for the *Eurobarometer*, that had been published one year earlier (European Commission, 2005). This document included the same question as the one in Miller et al, and it was reported that, on average, 70% accepted human evolution, and 10% either did not know or did not answer the answer question. Interestingly, it was noted that the acceptance among the New Member States² was actually considerably lower with only 60% who accepted human evolution. Indeed, when you take another look at the Miller diagram, you can clearly see, generally, that the acceptance rates in these countries are among the lowest.

Smaller, but still interesting surveys and polls have been conducted as well. In 2002, a Swiss professional company probed Europeans for their views on evolution. Only 40% agreed that the universe, the Earth and all life on it, had come about through natural

² The new member states include the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Malta and Cyprus.

processes. About 20% claimed to adhere to theistic evolution and the same number believed that God had created all organisms at one time within the last 10,000 years. Another twenty percent did not answer or did not know (Kutschera, 2003). In 2006, a BBC poll in the UK showed that 48% thought that evolution 'best described their view on the origin and development of life'. Creationism was the best description for 21% of the respondents, and Intelligent Design for 17%, with 13% undecided (Numbers, 2006, p. 408). In 2009, the British Council released the results of a survey on knowledge of and attitudes towards evolution in ten countries, including three European countries, Great Britain, Russia and Spain. One question read: 'To what extent do you agree or disagree that enough scientific evidence exists to support Charles Darwin's theory of evolution?' In Great Britain, 62% agreed and 9% disagreed, in Russia, 48% and 10% and in Spain 61% and 8%. However, what is particularly remarkable about these results is the staggering number of people who didn't answer or replied they did not know the answer: about 30% in Spain and Britain, and 42% in Russia. To the question 'Which of following views on origin of species comes closest to personal views?', 38% of the Britons and the Spanish, and 32% of the Russians replied that they accepted natural evolution, that is, without guidance by God. With between 18 and 25% adherents of guided evolution and between 13 and 18% creationists the British Council concluded that 'the majority of adults in Great Britain, Spain and Russia believe that life on Earth, including human life, evolved over time as a result of natural selection in which no God played a part.' (British Council, 2009) However, one could as easily interpret the same results as indicating that in none of these countries natural evolution is accepted by more than 40% of the population, which leaves a rather big pool for creationists to fish in. A recent poll by Ipsos MORI in 23 countries, including ten European countries, found that 41% of the global population accepts human evolution, and that 1 in 3 is creationist. Another 31% didn't know what to believe. Sweden (68%), Germany (65%) and Belgium (61%) ranked among the highest concerning the acceptance of evolution, with only 8 to 12% creationists. In Italy, Poland and Russia, however, the percentage of creationists rose to 21, 25 and 34% respectively. Again, with 60% Turkey had the highest percentage of creationists of all European countries (Ipsos Global @dvisory, 2011).

A couple of surveys are more related to science education and have probed for attitudes towards creationism and evolutionary theory among students and teachers. In September 2008, Clément *et al* presented the results of a large survey they had undertaken with 5,700 teachers in 14 countries (8 of which were European) at a conference in Turkey. The survey was part of an even larger project that included 19 countries. Their findings not only showed that creationist teachers form a huge majority in North-African countries, such as Tunisia and Morocco, but also that they are not uncommon in Romania (about 45%), Cyprus and Portugal (between 15 to 30%). In Italy, Finland and Hungary 15 to 18% of the non-biology teachers hold creationist beliefs, but only 3 to 6% of the biology teachers. There are almost no creationist

teachers in France and Estonia (Clément, et al., 2008). The most remarkable results of the project, summarized by Clément and Quessada themselves in a letter to *Science*, were:

Creationist beliefs were more likely in those with greater belief in God or greater religious observance, regardless of religion. Biology teachers were more evolutionist than their colleagues in only half of the countries surveyed. The longer a teacher trained at a university, the greater the acceptance of evolutionist ideas. (Clément & Quessada, 2009, p. 1644)

Two studies from the UK confirmed that not all teachers are equally well prepared to deal with creationist challenges in the classroom. Cleaves and Toplis (2007, p. 34) found that 'some mentors hold misconceptions about the status of evolution by natural selection', which made the authors wonder 'what 'alternative evidence they will accept and whether they would use ID materials in the classroom from the 'Truth in Science' movement.' Exactly this question was investigated by a study conducted by McCrory and Murphy (2009), who found that pre-service biology teachers were indeed highly susceptible to the propaganda in one of the DVDs that had been distributed by *Truth in Science*. Not only did nine out of ten participants take the claims in the DVD at face value, but the same number also 'perceived a legitimate scientific challenge to evolution. Less than one in ten challenged the claims in the DVD or was skeptical of its scientific credentials.' (McCrory & Murphy, 2009, p. 380)

Students' attitudes have been studied as well. Fulljames and Francis (2004) conducted a series of surveys probing students in Kenya and Scotland for their attitudes towards science and Christianity. One of their main findings was that in Scotland scientism, which they defined as the conviction that science provides absolutely true knowledge, correlated with the view that Christianity was necessarily creationist, but that the correlation did not hold in Kenya. The authors surmised that scientism makes Scottish students expect the same certainty in religious beliefs, whereas in Kenya, students simply take creationism for granted 'because they are not aware of alternative Christian interpretations of the Genesis creation stories.' (Fulljames & Francis, 2004, p. 172) According to the authors, the dissimilarity in results reflect different cultures of creationism.

To conclude this section, let us take a brief look at the available data concerning Islamic creationism. Two surveys have been conducted in which Turks have been asked about their views on evolution and human origins (Hameed, 2008). In the study by Miller and colleagues (2006) only 25% agreed to the statement that '[h]uman beings, as we know them, developed from earlier species of animals'. In a study by Hassan (2007) in 7 Islamic countries, 22% of Turkish adults believed that the theory of evolution was certainly or probably true (see figure 4).

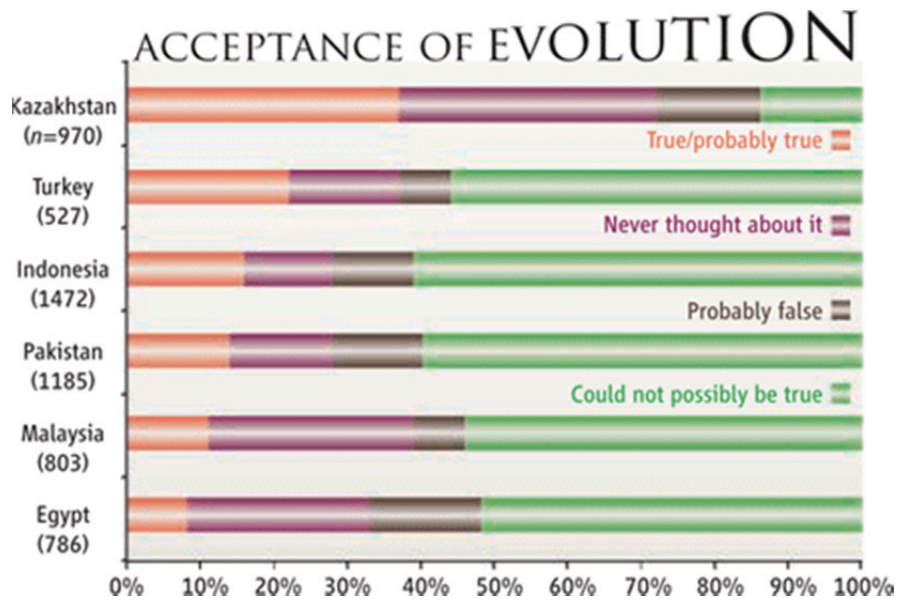


Figure 4 Acceptance of evolution in six Muslim countries (Hameed, 2008)

What are we to conclude from these studies? Comparisons are hard to make because the surveys tend to probe for different issues connected with creationism. However, one conclusion stands out as obvious: creationist beliefs are not equally distributed across the European continent. For instance, the inhabitants of Eastern European countries and Turkey appear to be highly sympathetic with creationism, whereas in Northern Europe the large majority of people accepts evolution. Another conclusion is that the acceptance of evolution is much higher in Europe than in the United States, except for Turkey. These international and regional differences cry out for an explanation. In the next section, we will focus on studies that have identified some of the factors that might be involved.

3.2.3 Explanatory studies

Just like the quantitative studies probe for different issues relating to creationism, the explanatory studies are concerned with accounting for different phenomena. For instance, in one set of studies the authors intend to explain why there are so many creationists in the United States, comparing to Europe. Miller and colleagues (2006) applied quantitative methods in order to extract the factors that account for these different levels in creationism. They found two factors that were particularly significant: the widespread religious fundamentalism and the politicization of the debate over evolution, phenomena which occur in the United States, but not in Europe. Szerszynski (2010) acknowledges that such quantitative approaches are valuable, but argues that they should be complemented with qualitative studies since they have no reach over individual differences in belief making. He refers to the sociological work

done by Eve and Harrold (1991), who have put the creation/evolution debates in a much larger context of two competing worldviews, which they termed 'cultural traditionalism' and 'cultural modernism'. He also mentions the cognitive approach taken by Evans (2000a), who argues that the popularity of creationist beliefs can in part be explained by their appeal to some of our cognitive predispositions. Szerszynski focuses more on the different roles religion plays in Europe, where liberal views on scripture dominates at least in the North-Western countries and in the United States, which is the hotbed of evangelical fundamentalism. As he puts it:

Organized religion in Europe, although in some ways weak, is nevertheless woven significantly into the lives of its constituent nations through binding symbols and rituals. By contrast America's religious history was shaped by the experience of pilgrimage and revolution, and was characterized by the rejection of old churches and their hierarchies. (Szerszynski, 2010, p. 162)

Unlike the lively religious marketplace in America with denominations competing and advertising their views in the media, the broad national churches in Northern Europe play a very different, but nonetheless important role as primarily cultural institutions with strong symbolic meanings and as markers of key moments in people's lives. The broad scope of the national churches means that the religious focus is much more directed against consensus and homogeneity than against highlighting differences on controversial issues such as evolutionary theory.

Another important factor, according to Szerszynski, is that in Europe education is more under control at a national level than in the United States:

Such a context, in which diversity of opinion is contained within a broadly-democratic framework of shared beliefs and values, makes it far harder to promote unorthodox ideas in schools, whatever views teachers or parents may hold individually. (Szerszynski, 2010, p. 164)

Other scholars agree that education has a considerable impact on the distribution of creationist beliefs, but they sometimes differ over which kind of influence it exerts. Kutschera (2008a) and Borczyk (2010), for instance, argue that creationism in Europe is on the rise because of the fact that religious education, which is often funded by the state and sometimes even compulsory in European countries, is provided much earlier than science education, thus shaping a receptive audience for creationist beliefs. Williams (2008) and Locke (2004), however, see compulsory religious education as one of the possible reasons why creationist activism has not gained as much support in the UK as in the US. If religion is already being taught in schools, even in those funded by the state, there might be no reason for religious groups to challenge that policy. Nevertheless, in some countries like the UK or the Netherlands, the freedom which religious education enjoys in state-sponsored schools, especially comparing to the US,

has not always stopped creationists from demanding equal time for creationism or intelligent design in the biology classes (Blancke, 2010; Williams, 2008). Also, Locke (2004) is in line with Szerszynski (2010) that the fact that most European education is under state control has a negative effect on the success of creationist beliefs. However, he thinks the reason for that is not so much that the resulting concentration of the educational system creates a cultural space in which there is less room for eccentric ideas. Rather, he assumes that the US educational system leaves public schools far more vulnerable to local and parental concerns, which is less the case when education is organized by the state. Coleman and Carlin (1996) argue that because in the UK religious education has more or less developed from bible classes to a comprehensive introduction to the world's largest faiths, students' tolerance towards alternative religious viewpoints has increased, which, in turn, has dramatically reduced their sensibility to absolutistic claims.

Religion itself of course plays an important part in the dissemination of creationism. For instance, Clément *et al* (2008) found that Orthodox teachers were more creationist than their Catholic and Protestant colleagues. However, the claim that religion has an effect needs some qualifying. Catholics in Lebanon and Burkina Faso are a lot more creationist than their fellow believers in Europe. The nature of religion does have an impact on the popularity of creationism, but even more significant appears to be how frequently people practice their religion. Other relative factors were the socio-economic development of a country, the country's identity, people's age (the younger the more creationist) and the level of scientific training (Clément, et al., 2008). These findings imply that we need to be careful in making generalizing statements across religions, and that we need to take local or national factors into account as well. Coleman and Carlin (1996) suggested that creationism is rather unsuccessful in the UK because the mainstream religious centre has softened considerably over the last decades. Bishops of the Anglican church and the Archbishop of Canterbury have publicly rejected creationism and Intelligent Design, thereby siding with the major scientific voices, like Richard Dawkins (Allgaier, in press; Williams, 2008). Also, conservative Christians have always formed a religious minority, which probably has made them more tolerant towards other religious views. (Coleman & Carlin, 1996) However, the fact that we need to be careful about generalizing across religions does not entail that the nature of religion has no effect whatsoever. Hjermitsev (2010b) argues that in Denmark mainstream Lutheranism has followed a theologically liberal path, by which it opened up the intellectual space its followers needed in order to reconcile their faith with evolution. Flipse (in press-b) has documented how theological concerns already drove the Dutch conservative Calvinists towards George McCrady Price's flood geology in the 1930s, which was long before this fundamentalist strand became dominant in the United States (Numbers, 2006). And Edis (2007, p. 120) argues that for Muslim creationists it is

not difficult to find a receptive audience because they ‘do not oppose the consensus of their own intellectual high culture. [...] Muslim creationists are insiders.’

Nevertheless, religion is just one of the many factors that determine the distribution of creationist beliefs. Also important are the media that are available to creationists by which they can promote their religious views (Coleman & Carlin, 1996, 2004). In the United States, it is rather easy for fundamentalists and evangelicals to establish their own television and radio stations and acquire a broadcasting license. In the United Kingdom however, until fairly recently, the BBC largely controlled television and radio, thereby severely restricting access to the media for creationists (Coleman & Carlin, 1996). In fact, getting the BBC to spend time on their cause was one of the main concerns of British creationists during the 1970s (Numbers, 2006, p. 362). The same applies to the opportunities creationists have to partake in the political process. In the United States, where the electoral system is much more decentralized, creationists can exert influence through local initiatives to push their agenda. In the UK, however, where politics are much more centralized and the power is mainly in the hands of parliament, it is much harder for smaller interest groups to make their voices heard. (Coleman & Carlin, 1996) However, as Coleman and Carlin (1996) note, an increasing liberalization of the media and a growing demand for regional autonomy, might result in a change of circumstances that is more favorable to creationism.

Although some European countries appear to be very successful in warding off creationist activism, the facts we have discussed above do reveal that creationism has found for itself a distinctive foothold in the European religious landscape. In that regard, several authors have marked the enormous potential of creationism to adapt itself to local circumstances. According to Edis (1999), the Christian creationism of the ICR was so easily transplanted into an Islamic context because ‘creationism mobilizes traditional Abrahamic convictions about the moral significance of the natural world against the threat of social modernity.’ The creationists of both the ICR and BAV ‘answer a need to claim science for the side of old-time social morality, and both correctly see that evolution is a major intellectual obstacle.’ Levit and colleagues (2007, p. 16) argue that creationism could become so popular in Russia

because the most important creationist arguments are of a universal anti-scientific nature, they are easily converted into any cultural context and were able therefore to influence the Orthodox creationists, who saw them as useful in their doctrinal attack on secular education.

These examples also hint at the extraordinary talent of creationists to identify people’s main moral, social, and political concerns with evolution. In former parts of the Soviet Union, evolution is squared with communism, whereas in Muslim communities, evolution stands for the moral degradation that allegedly comes with western

secularism. By tapping into people's biggest fears, creationism is able to present itself as the ideal remedy against those purported cultural and political maladies.

3.2.4 Other studies

Before we conclude this review, let us briefly point to some publications that did not fall into the types we distinguished above. A couple of studies are simply not concerned with gathering historical facts, or quantitative data relating to European creationism, nor do they attempt to explain creationism. Allgaier (2010, in press; 2006), for instance, mainly focuses on the controversy over Emmanuel College to establish how the media report such an event and which role experts play therein. Locke (2004, p. 54) analyzes the manner in which creationists in their discourse 'draw on a range of models of science in accordance with the changing needs of argumentative intent.' Also, because creationism is on the rise, we see an increase in anti-creationist activities as well. Organizations are founded with the explicit goal of monitoring and counteracting national and European creationism, such as, for instance, the British Centre for Science Education. Also, recently a couple of philosophical articles by European scholars have been published that either engage with American (Boudry, et al., 2010a, 2010b; Haggström, 2007a) or European creationism (Blancke, et al., 2011; Blancke, Boudry, et al., in press).

3.3 The gaps

This review has established at least two important facts about creationism in Europe. First, although European creationists are not as well organized as in the United States and do not live in proportional numbers in each European country, they certainly exist and have considerable influence. Moreover, sometimes they are very active and tremendously keen to gain access to political power with the explicit intention of influencing national and European educational policy to their advantage. Second, because people are becoming increasingly aware of the fact that creationism is indeed a truly extant phenomenon, a steadily growing number of European scholars has taken an interest in this subject. As a result, publications dealing with creationism in a particular European country or with European creationism in general have appeared more frequently over the last ten years. However, because the research concerning

creationism in Europe is only nascent, it should not come as a surprise that there are still many gaps that need to be addressed in order to arrive at a sufficient understanding of the phenomenon.

What is most missing from the literature is a sustained approach of the subject of creationism in Europe. As to the historical literature, some papers list a series of creationist incidents that occurred in several European countries, but these overviews are usually quite limited and anecdotal. This is due to the fact that they are often written with the intention of giving some indication that creationists are indeed active in Europe. Other papers discuss creationism in a particular European country in a little more detail, but these are scattered across different journals and books and sometimes published in the native language (for instance, in France, see Arnould, 1996; 2007; in Denmark, see Hjermitsev, 2010a; in Germany, see Kutschera, 2007a; 2007b; Lepeltier, 2007), which makes the findings documented in these publications somewhat difficult to access and compare. In addition, a large population of local studies are published in newspapers and magazines, which means they are not systematically registered in scholarly databases. Moreover, authors tend to take different angles, focus on different aspects involving creationism and rarely attempt to put their research in a European context. The most common point of reference is the United States, which is understandable and also necessary. However, it is problematic if our aim is to attain at a proper understanding of creationism in Europe. To that end we will also need more research on creationism in a greater variety of countries, preferably conducted from a similar perspective.

The same remark also applies to quantitative studies. European surveys are sparse, fragmented and methodologically inconsistent. The Eurobarometer poll, for instance, is only related to an assessment of scientific literacy and does not have much explanatory value concerning complex issues of science and religion and positions such as young-earth creationism, intelligent design, theistic evolution and naturalistic evolution. The often cited comparative Miller-study in *Science* equals results from different polls that are in fact not comparable, since they are based on different wordings and questions and do not distinguish between human evolution and evolution in general. Nor do they make the distinction between evolution and evolutionary theory.

As long as a uniform approach is lacking in both historical and quantitative studies, a reliable assessment of the distribution of creationist beliefs and activism across Europe will be difficult to arrive at. However, such an assessment is absolutely necessary if we want to have solid explanations of why creationism is more popular in some European countries than others. These explanatory studies would also, somewhat paradoxically, benefit from a richer diversity in the types of studies that focus on European creationism: historians can track the background to arguments, groups and organizations. Anthropologists can study internal organization of creationist groups and produce typical anthropological portraits of creationists from around Europe, while

sociologists can generate data on how creationism is related to particular social groups, whether these groups form a minority or not and how creationist beliefs relate to other representations within creationist groups. Religious scholars can examine the impact of particular religions and theological traditions on the popularity of creationism and the interaction of religion with other factors. Educational scientists can identify creationist sympathies among teachers and students, probe for their understanding of evolutionary theory and establish how both factors are related. Legal scholars and political scientists can evaluate the juridical and political background against which European creationist activism makes sense. For more inspiration European scholars can look across the Atlantic and check from which angles and how American creationism has been approached and studied. However, such a wide range in perspectives will only be fruitful under the condition that within each type researchers apply similar methods and concentrate on the very same issues. To sum up, a comprehensive, interdisciplinary understanding of creationism in Europe will not be the result of the sum of all the research that has been executed separately in each European country. Instead, it requires transnational coordination via cooperation both across the European continent and with experienced scholars, research centres and organizations in the United States. Given the linguistic, religious, and financial barriers between the European countries, such cooperation might prove to be complicated, but there is no other option. Only then will the material necessary for a systematic analysis of creationism in Europe become available.

3.4 The prospects

Fortunately, the first promising signs of such transnational forms of cooperation are emerging. Out of discontent with the fragmented status of the research on creationism in Europe, the authors of this paper have taken the initiative to bring together scholars from several European countries for a historical study of creationism in Europe. The results of this project will be made widely available through an edited volume with the title *The history of creationism in Europe*, which will be published with the Johns Hopkins University Press.

The understanding of creationism in Europe will make essential contributions to related fields of inquiry. Although the diverse European cultural landscape might form an important impediment to transnational cooperation, the same diversity also creates unique opportunities to compare different contexts and establish which impact each

factor has on the distribution and popularity of creationist and evolutionist beliefs. As such, the study of creationism in Europe will not only add to the understanding of creationism worldwide, but also to the understanding of the historical relation between science and religion. In this tradition, scholars have proposed that this relationship is complex, often mediated by even very local factors (Dixon, et al., 2010), which is a thesis that can be tested and further developed in application to European creationism. Also, the study of European creationism will improve the understanding of cultural evolution in general. Philosophers (Blancke & De Smedt, forthcoming) and cognitive scientists (E. M. Evans, 2000a) have argued that creationism holds much more intuitive appeal to the human mind than evolutionary theory does, because creationist beliefs tap into our natural predilections for essentialist, teleological and intentional modes of thinking. Nevertheless, creationism appears not to be as widespread in Europe as in the USA and receives much more support in one country than another. This subject somewhat resonates with a discussion published earlier in *Religion* on the 'naturalness' of atheism (J. L. Barrett, 2010; Bering, 2010; Geertz & Markússon, 2010) Given the cultural diversity in Europe, the study of creationism in Europe could shed light on how contextual factors impede or stimulate universal cognitive predispositions. As these factors might be of an economic, social, political, psychological, religious, historical or philosophical nature, it will not only be important to rely on the knowhow that is available in the range of scientific research domains studying these kind of factors, but also, these domains themselves would certainly be enriched by studying creationism in Europe.

We would like to close this section by making one remark concerning methodology, which we think is important. To avoid confusion, it will be of the utmost importance to distinguish between intuitive, local and imported creationism. Intuitive creationism comprises the set of creationist beliefs people adhere to without explicating, defending or propagating them. Because it usually does not come to the surface and make itself known in the public space, this type of creationism is the hardest to trace, even though further quantitative studies would be illuminating in this context. The sentiments of intuitive creationism can be rallied by the other two types of creationism, local and imported creationism, especially in a situation where people perceive (or are made to perceive) a threat to cherished beliefs or values. Local creationism is the type of activist creationism that emerges from local religious contexts; imported creationism is activist creationism that has been brought into European countries, usually by American or Turkish creationists. The study of creationism in Europe can only be truly successful if it attends to the manner in which the three types of creationism interconnect, against the background of the variety of contextual factors we discussed above.

3.5 Conclusions

Activist creationism, both local and imported, has been on the rise for the last fifteen years. The number of scholars dealing with this subject has increased concomitantly which has translated itself into a growing list of publications, including historical, quantitative and explanatory studies. However, we need a uniform approach which would allow for much needed comparative studies by which the impact of a variety of contextual factors on the distribution of creationist beliefs and activism can be traced. The result would be a comprehensive understanding of creationism in Europe, a corpus of knowledge from which researchers from a range of academic domains would benefit. However, this corpus can be only be attained by international cooperation between scholars and, research groups both in Europe and the United States. To meet this end the first steps towards such a collaboration has already been taken.

Chapter 4

Catholic responses to evolution, 1859-2009: local influences and mid-scale patterns¹

Abstract

This article explores the extant literature on Catholic responses to evolution and evolutionary theory between 1859, the year of publication of Charles Darwin's *On the origin of species*, and 2009, the year in which the scientific world celebrated its 150th anniversary. We discern a general process by which Catholic intellectuals adopt an increasingly tolerant attitude towards evolution. Local factors influenced the pace by which this process occurred. The Vatican long opposed this trend, but today, it has joined its flock in accepting evolution. Evolutionary theory, however, rendering a naturalistic account of the living world, remains a formidable stumbling block.

¹ This chapter is currently under review with *Journal of Religious History* (Blancke, submitted)

4.1 Introduction

In his influential book, *Science and religion. Some historical perspectives*, John Brooke (1991, p. 52) convincingly argued that, within the history of science and religion, grand narratives can be no longer defended. In particular, the popular image of a continuous war between these two cultural domains fails to reflect what has actually occurred and still occurs. There exists no general negative religious response to a unified corpus of scientific knowledge. Instead, through modern historical research a variety of religious responses has emerged (Livingstone, 2009). Moreover, these reactions are concerned with particular (interpretations of) scientific issues or discussions. A majority of religious people tend to show little hostility towards science or to scientific practise in general. Therefore, at both sides of the equation, things have become increasingly complex.²

In this paper I intend to establish whether, historically, catholic responses to evolution and evolutionary theory³ reveal a similar level of complexity. A quick look at the contemporary debate about scientific creationism and Intelligent Design (ID), suggests such an approach is at the least viable. It discloses a wide range of catholic attitudes, from strong sympathy for scientific creationism (Harrison, 2001), over a radical defence of ID (Behe, 1996) to a full acceptance of evolutionary theory (and an according rejection of any antievolutionary position) (K. R. Miller, 1999). Notwithstanding the fact that some of these opinions form only a minority position, they do point towards a certain flexibility in catholic orthodoxy. If we can indeed ascertain that catholic responses to evolution are complex, we can expect that local factors, in parallel with their significance in Protestant reactions to evolution (Livingstone, 1999), were involved. However, we should not be content with merely asserting that the historical relation between evolution and Roman Catholicism is complex. The idea that we need to abandon grand historical narratives, does not imply that we need to stop looking for general trends or “mid-scale patterns” (Numbers, 2010, p. 264). I have opted to focus primarily on secondary literature. This approach creates the unique opportunity to compare the Catholic reception of evolution over different

² This contribution of Brooke to the historiography of science and religion boils down to what Ronald Numbers has dubbed the “complexity thesis” (Numbers, 2010).

³ I will here employ the terms “evolutionary theory” and “evolution” consistently in clearly distinct ways. Evolutionary theory denotes the scientific theory of evolution by natural selection, sexual selection and genetic drift. Evolution merely denotes “evolutionary process”. Therefore one can accept evolution, without necessarily accepting evolutionary theory. I have avoided the term “Darwinism” altogether because of its ambiguity and its ideological overtones.

national settings. As such, we can discern both the significance of local factors and the occurrence of common patterns, which otherwise would remain obscure.

First, I will discuss how the Vatican initially reacted to evolution, more specifically in the period between 1859, the year in which Darwin published his seminal volume *On the origin of species*, and 1907, the year in which pope Pius X issued the encyclical *Pascendi dominici gregis* in condemnation of the modernist movement within the Church. Next, I will explore how individual Catholics and catholic communities dealt with evolution. Particularly in this section, I will identify the local factors that influenced their responses and how they did so; but I will also demonstrate that, gradually, Catholics in general tended to shift towards a more relaxed position concerning evolution, although accepting evolutionary theory to a full extent remains difficult. Third, I will shortly demonstrate that, in the end and somewhat reluctantly, even the Vatican complied to this pattern.

4.2 Early Vatican responses to evolutionary theory, 1859-1907

The history of Protestantism is riddled with schisms and sudden appearances of new cults and churches. Because of the resulting plethora of denominations, it is not very surprising to find that Protestant reactions to evolutionary theory have varied widely, thus indeed establishing the complex pattern that Brooke and others have discerned.⁴ The Catholic church, in contrast, is characterized by a strictly hierarchical structure, in which the doctrine of Catholic faith is monopolized and carefully guarded by the Holy See in Rome. Catholics, however, have been as creative as Protestants in responding to the intellectual and religious challenges posed by evolution. Thus, at the least, some Catholics had the impression they were allowed some freedom to formulate their own position on this issue.

That they could have this impression was in no small part caused by the extreme caution by which the Vatican itself treated the matter of evolution. Having experienced serious embarrassment after the Galilei case (in which the Church had put Galilei's work on the *Index* in 1633), the Vatican opted to abstain from formulating any official statement on yet another unsettling development in modern science (O'Leary, 2006).

⁴ For a discussion of a variety of Protestant reactions to evolutionary theory in the 19th century, see e.g. Moore (1979), Livingstone (1987) and Roberts (1988)

Instead, it resorted to a more “pragmatic policy” (Artigas, et al., 2006, 2008), dealing with evolutionary ideas and writings on a case-to-case basis. Between 1870 and 1925, the outcome of these cases was generally not in favour of the attempts made by clergymen, theologians and Catholic scientists to reconcile evolution with Catholic faith. But the message the Vatican tried to convey came across far less strongly than if it had done so through a public condemnation. Of the six cases Artigas and his colleagues discuss in their book *Negotiating Darwin*, there is only one case in which a publication, a book written by Raffaello Caverni, was put on the *Index* for its pro-evolutionary views (Artigas, et al., 2006). This sanction was expressly intended as a warning for others to steer clear of evolution-friendly ideas. However, because books were always put on the *Index* without stating the reason why, this signal was to no avail. Later, authors were asked to publicly retract their publications instead. This offered them the opportunity to avoid a public condemnation of their work. For the Vatican, these retractions had the advantage of including an explanation as to why the work was being retracted. But, Catholic proponents of evolution only took home the message that they should proceed with care, not that they should not proceed at all. As a result, the Vatican was incapable of putting an end to the production of evolutionary writings.

Nevertheless, the Vatican’s rigid adversity towards evolution lasted well into the 1920s. This was not so much because evolution questioned a literal interpretation of the Bible, more particularly of the book of Genesis, but because evolutionary theory, especially Darwin’s formulation of it, seemed to deny certain tenets of Catholic dogma (Appleby, 1999). Most importantly, the special creation of man was perceived as being under threat. However, it should be noted that even the Catholic intellectuals who sought to harmonize their faith with evolution did not dare to go as far as to question the divine origin of the human soul, nor did they question the creation of the first woman out of the first man’s body. They only proposed that the first man’s body could have been somehow prepared through an evolutionary process that was guided by God. For the traditionalists in the Vatican, however, even this minimal concession was a bridge too far. They argued that Catholic dogma clearly stated that man was the direct result of God’s work, in both his soul and his body.

Another reason why the Vatican opposed evolution was the widespread association of evolution with atheism and materialism. Indeed, all across Europe proponents of both schools of thought had easily incorporated evolution in support of their ideas. They hailed Darwin as the scientist who had irrefutably demonstrated that all life, including human life, was the contingent outcome of mindless, natural processes. Under such an interpretation, of course, the Church could not possibly embrace evolutionary science. Evolutionary theists, however, equally acknowledged that evolution had become strongly associated with materialism and atheism, but they insisted that there did not exist any logical necessity between them. They believed that, once they had disconnected evolution from these unwelcome alliances, a Catholic could accept

evolution and yet did not have to give up his faith. However, those who propounded and defended these ideas did not have sufficient power to change the adverse current within the Vatican for a long time. The influence of the traditionalist parties within the Church simply proved too strong.

The traditionalist stance on the interpretation of Catholic dogma and on evolution was zealously propagated by the authors of *La Civiltà Cattolica* (CC), the Jesuit periodical that first appeared in April 1850 under the encouragement of pope Pius IX. Although recently there has been some discussion as to the exact role CC played during the second half of the nineteenth century in shaping the Vatican's attitude towards evolution (Artigas, et al., 2006; Brundell, 2001), CC is generally recognized to have had "a certain authority" due to its "special relationship with the Holy See" (Artigas, et al., 2006, p. 27). Since 1860, CC regularly published articles expounding strident anti-evolutionary positions and acrid reviews of pro-evolutionary works written by fellow Catholics. By the turn of the twentieth century, when evolution turned out to have an increasing appeal to catholic intellectuals, CC responded by boosting its production of antievolutionary writings, and also eagerly republished the retractions made by pro-evolutionary authors in other journals. Thus, CC helped fabricating and uncompromisingly communicated the message that the Church heartily disapproved of the attempts made by members of its flock to reconcile Catholic faith with evolution. However, CC never functioned as its official organ. Nor did it succeed in extracting an official condemnation of evolution from the Holy See (Artigas, et al., 2006, 2008; Brundell, 2001). Instead, CC had to content itself with the condemnation of other issues, which could be considered to be related with the topic of evolution, but were not necessarily so. Hence, defenders of evolution could just as easily avoid the anti-evolutionary conclusions the authors of CC and their co-traditionalists were so keen on drawing.

The only explicit statement made by a Catholic authority on the issue of evolution before 1950 can be found in the decrees that were drafted after the provincial Council of Cologne, held in 1860 (Artigas, et al., 2006, 2008; Brundell, 2001; O'Leary, 2006). Although the Vatican officially approved of these documents, they should not be understood as conveying any position of the Church as a whole. As the council's authority was restricted to the diocese of Cologne only, it lacked the hierarchical power to issue such documents. Nevertheless, its assessment of evolutionary theory in relation to the interpretation of the book of Genesis and Catholic faith foreshadowed the position that gleamed through the later Vatican policy, not only in its content, but also in its intent to send a clear warning against evolutionary teachings and its consequent failure to do so. The words of the decree read: "The first parents were created directly by God. Therefore, we declare as contrary to Sacred Scripture and to the faith the opinion of those who are not ashamed to assert that man, insofar as his body is concerned, came to be by a spontaneous change from imperfect nature to the most perfect and, in

continuous process, finally human.” (quoted in Artigas, et al., 2006, p. 23) At first sight, these words constitute a forthright rejection of any evolutionary infusion into Catholic dogma, but here is the rub: it only condemns “spontaneous change”, not evolutionary change per se. The decree could therefore be just as easily and sensibly interpreted to allow for an evolutionary process guided by God. This kind of confusion on how to interpret the Church’s actions and official documents became a recurrent theme in the Catholics’ attitude towards evolution. The Church’s enduring hesitance to speak out definitely on the topic of evolution fuelled this ambivalence, creating the ideal environment for alternative opinions to emerge.

The Holy See, however, was not equally prudent in condemning other issues it considered a threat to catholic orthodoxy. By the end of the nineteenth century the Church faced one of its greatest challenges ever, a movement that developed within its own ranks, called modernism. As ‘modernism’ covered a wide range of opinions and soon turned into the metaphorical stick to beat a dog with, the term is hard to define in great detail⁵; but commonly refers to a group of scholars that “adopted a critical and skeptical attitude toward the traditional doctrines of their church” (O’Leary, 2006, p. 114). In that spirit, they brought the methods of historical research and the natural sciences to bear on the interpretation of the Bible and Catholic dogma. It was a genuine attempt to attune Catholic faith to the intellectual demands of modern times. This approach, however, sharply contrasted with the revival of neo-Thomism in Catholic thought, instigated by pope Leo XIII through the encyclical *Patris Aeterni* (1879) which marked the start of the First Vatican Council. Neo-Thomism, a philosophy that was primarily based on the works of the medieval theologian Thomas of Aquino, was intended to bridge Catholic faith and modern science. In effect, this “synthesis” boiled down to moulding scientific findings into the preset framework of catholic dogma (Paul, 1988, p. 412). Modernists, however, concluded that the dogma’s themselves evolved. Unsurprisingly, the Vatican regarded modernism as one of the biggest evils of all time, and battled it in a fierce campaign that would not cease until the second Vatican, well into the twentieth century. One important step in this campaign was the publication of the encyclical *Pascendi Dominici Gregis* (1907), in which pope Pius X in no uncertain terms denounced modernism as “the synthesis of all heresies”. In other words, it was worse than Protestantism. The encyclical also included passages that were clearly intended to target evolutionary thought as part of the modernist heresy, but again, because of the rather indirect approach, it failed to get the message through (O’Leary, 2006). For instance, at the Catholic university of Louvain in Belgium, a group of progressive

⁵ Brundell (2001, p. 82) writes: “[M]odernism took many forms depending on the perceptions of its various opponents, so that the meaning of the term became very imprecise and came to be applied to any and every suspected or alleged deviation from accepted orthodoxy.”

Catholic intellectuals did not interpret the encyclical in that sense and continued their efforts to reconcile their faith with evolution (De Bont, 2008a).

Another disturbing phenomenon the Church had to deal with was the rise of Americanism. Like the very name suggests, the movement originated within the Church in the United States. It grew out the continuous efforts by liberal Catholics to help the fast growing masses of Catholic immigrants from all over the world, accommodate to the specifics of North-American culture (Appleby, 1999). Americanists were in favour of the separation between State and Church, which is inscribed in the US Constitution, and argued for more individual liberty in dealing with religious questions (Artigas, et al., 2006; O'Leary, 2006). This atypical emphasis on individualism increasingly worried traditionalists both in the United States and in Rome, especially when the main tenets of the movement became popular in France, which had become increasingly secularized after the revolution in 1789. According to the traditionalists, Americanism equated Protestantism, and as a result in 1899, the pope wrote a letter *Testem Benevolentiae* to the archbishop of Baltimore, in which he condemned the movement as unorthodox.

Americanism had become deeply associated with evolutionism. In 1896 John Zahm, a prominent Catholic priest who supported the cause of Americanism, had published a book called *Evolution and Dogma*, in which he defended evolution as being in line with Catholic orthodoxy, even if this included the evolution of the human body. He also claimed that both St.-Augustine and Thomas of Aquino had been evolutionists. The book was soon translated into French and Italian and became highly popular in both the US and Europe, but, understandably, not in Rome (O'Leary, 2006). CC published some highly critical reviews of Zahm's work; steps were taken to put the book on the Index, but these efforts did not pass. When Zahm was asked to retract the book, he refused. In the end, the traditionalists had to be satisfied with the publication – without Zahm's consent – of a letter he had written to his publisher in Italy in which he asked him to withdraw the Italian translation of his work (Artigas, et al., 2006, 2008). However, neither the pope's letter nor the actions taken against Zahm's work were to any avail. Although it was clear that the Church did not favour evolution, pro-evolutionary Catholic intellectuals did not get the feeling that the Vatican conceived of their ideas as unorthodox.

4.3 Catholics respond to evolutionary theory, 1859-1950

The Vatican's negative attitude towards evolution, however, cannot be simply extended to include the views of all individual Catholics (Corsi & Weindling, 1985, pp. 725-726). Granted, many of them found great difficulties in embracing a concept that, *prima facie*, seemed to fuel so many disturbing irreligious ideologies and therefore flung in the face of some of their most cherished beliefs. They were primarily concerned with the fact that Darwin's theory taught that humans originated from a simian ancestor through a mindless process, called natural selection. Abhorrence in reaction to evolution was therefore common, especially during the early reception decades; the duration of that particular phase, however, varied heavily, depending on national context. Nevertheless, the Vatican's adverse but hesitant stance on the matter did play an important role in shaping the attitude of the members of its flock, but it constituted only one element in a wider collection of factors that influenced Catholics' appreciation of evolutionary theory. These factors explain, in part, why individual Catholics and local Catholic communities or networks could develop more liberal views that strayed from the orthodoxy as perceived by traditionalists. Here, we will analyze these various local circumstances that had an impact on the ways in which Catholics dealt with the introduction and consequent dissemination of evolutionary thought.

One factor that had a major impact on the initial response of Catholics was the question whether evolution was presented by proponents of evolution as inimical to religion or not. In other words, did evolutionists represent their views in support of a materialist or atheist worldview? This is a key-element well documented by Livingstone (1999). In his research on the differential reception of Darwinism in the three Calvinist communities of Belfast, Edinburgh, and Princeton, he shows that the most ardent opposition arose in Belfast where evolution had been introduced to the faithful through the address John Tyndall had delivered at a local meeting of the British Association for the Advancement of Science (BAAA). In his address, Tyndall highlighted the antireligious implications of Darwinian theory, thereby provoking a strong religious reaction among the local Calvinist community. But this reaction was not confined to the Protestants only. Belfast Catholics too immediately associated evolutionism with atheism and hence resented it fiercely, an attitude that would hardly change until after the second World War (O'Leary, 2009).

However, when evolutionists presented their views as compatible with Catholic faith, it met with much less adversity. In Belgium, for instance, evolution had been introduced a couple of decades before Darwin had written his *Origin*. Jean d'Omalus Halloy (1783-1875), a respected geologist and a dominant figure in the Belgian scientific establishment during the first three quarters of the nineteenth century, defended a kind

of spiritual evolutionism – with humans clearly distinct from the rest of creation – that he thought could encompass both evolution and Catholicism. His version of evolution did not engender any fierce rejection or opposition of evolution on the account of Belgian Catholics. It's not that they endorsed d'Omalius views – they presumably did not – but they simply remained silent on the issue (De Bont, 2008a). With no threatening formulation of evolutionary thought to deal with, there simply was no need for an outspoken reaction. Belgium was not the only country where evolutionary theory was initially received by relative silence.⁶ Similarly, in its neighbouring country, the Netherlands, the Catholic community did not express a strong opinion on Darwinism until the late 1860s. There too, scientists introduced evolution – again, before the arrival of Darwinian theory – as a concept reconcilable with Christian faith (Bulhof, 1988). Instead, evolution was caught up in a theological discussion on the existence of miracles and in the philosophical discussion on the nature and appropriate methods of science. These rather academic discussions between more or less modern Protestant theologians and between scientists, had no real or direct impact on the beliefs of the common Catholic. Because the Dutch Catholics lived in the safe seclusion of their own community, most of them had not heard of evolution anyway (Leeuwenburgh & Van der Heide, 2008). In 1868, however, this situation changed. Karl Vogt, a famous German materialist and a co-worker of Ernst Haeckel, delivered a series of lectures in Rotterdam in one of which he discussed the primate ancestry of humans. This position was unacceptable for both Dutch Catholics and Protestants but it were mainly conservative Catholics who reacted with an outburst of antievolutionary writings which formed the opinion for decades to come (Leeuwenburgh, 2009). It was not until the beginning of the twentieth century that, in the Netherlands at least, more nuanced Catholic voices could be heard and evolutionary theory remained suspicious until the 1960s (Flipse, 2008, in press-a). This was long after Dutch liberal – and even some orthodox – protestants had made their peace with evolutionary science.

Adverse Catholic reactions towards evolutionism intensified when the distinction between the Catholic church and proponents of evolution was marked politically. As Thomas Glick pointed out, centralization plays a key role therein (Glick, 2001). In Spain, intransigent Catholic groups exerted substantial power over policymaking. By controlling the educational system and by censure, they were able to slow down the dissemination of evolutionary thought. As a result, Spanish science was characterized

⁶ Silence was also the predominant reaction among French Catholics, including Catholic scientists. As such, their attitude can be better explained as taking part in a general French reaction in which evolution was simply ignored as being too speculative (Stebbins, 1988). In France too, however, Catholic antievolutionary sentiments were fuelled by the anticlerical, materialist and atheist mode evolutionists presented their ideas (Paul, 1979).

by antievolutionism (Pelayo, 2008). Moreover, Spanish Catholic intellectuals considered their country to be the last bulwark in Europe against the invasion of materialist ideologies from the north. In contrast, liberal intellectuals and reformers identified themselves with Darwinism. As Glick put it: "In the debate between the 'two Spains', liberal and conservative, modern and traditional, Darwinism was a touchstone." (Glick, 1988, p. 344) Only by the turn of the century, a national educational reform and the development of evolutionary research programs finally paved the way for the introduction of evolution into official science (Pelayo, 2008).

Evidently, the debates on evolution were hardly ever restricted to purely scientific arguments. Not only did evolution become easily associated with materialist, atheist ideologies by both Catholics and evolutionists, but evolution also got as easily intertwined with local political, sociological or philosophical discussions. In the Netherlands, evolution was initially incorporated in the local and rather moderate theological and philosophical discussions over miracles and the nature of science. In the US, evolutionism was embraced by the liberal clergy within the Americanist movement, while more traditional parties sided with the disapproving position of the Vatican, a tension epitomized by the Zahm case. But the debates over Americanism were also of a practical nature, particularly about how to deal with the catholic immigrant communities that flooded the States (Appleby, 1999). Internationally, evolution became a major issue during the modernist crisis, thereby becoming highly significant for the delineation of Catholic orthodoxy (O'Leary, 2006). The higher the stakes of the debate – and in the case of modernism they were extremely high – the more intense the debate on evolution became and the more non-scientific arguments weighted in.

Scientific arguments were not entirely absent from the debates. Both sides drew heavily on contemporary scientific findings and arguments to bolster their position. Sometimes, science was simply invoked as an authority to bolster up one's own ideological position. In France, for instance, Catholic intellectuals referred to the prevailing opinion within the national scientific community that evolutionary theory bore too many deficiencies to be called a proper science. Generally, French scientists considered themselves to be positivists and argued that Darwin's theory simply relied too much on idle speculation and too little on rigorous observation and experiments (Paul, 1979). Elsewhere, opponents of evolutionary theory, in particular of the Darwinian variety, had no trouble in finding genuine, scientific ammunition to fire up their attacks. Although the concept of common descent had met with little scientific hostility and evolution itself was rather easily accepted by the scientific community, especially in the Anglo-Saxon world, the mechanism of natural selection was not so heartily welcomed. Multiple alleged difficulties with the theory undermined the explanatory power of the concept: there were too little fossils to illustrate a *gradual* change from one species into another; the physicist William Thomson, better known as Lord Kelvin, had calculated that the age of the Earth did not allow for (the slow process

of) natural selection to bring about the biological complexity we see all around us. Moreover, Darwin could not provide his critics with a satisfying theory of how heritable characteristics of organisms were preserved and passed on from generation to generation. Darwin was unable to formulate an apt response to these problems and for many scientists this rendered his case for natural selection unconvincing. Starting from the 1870s the combination of these criticisms lead to a period in which alternative evolutionary theories like neo-Lamarckism, orthogenesis and saltationism almost completely overshadowed natural selection (Bowler, 1992). Unsurprisingly, religious opponents of Darwin's theory did not hesitate to apply these arguments in support of their antievolutionary position.

The scientific neglect of natural selection also had the effect of creating the intellectual space that was necessary for the more liberal believers to construe their own theistic versions of evolutionism. If evolution had been defined strictly to include Darwinian evolution, Catholic thinkers would have found it much harder to reconcile the main tenets of their faith with evolution. In the *Origin* (1859), Darwin himself hinted at a possible solution for the conflict between his theory and belief in God. Couldn't God, Darwin surmised, have initiated the law of natural selection, just like he had set off the laws of physics and then let these laws do their intended work? Isn't such an act of creation more worthy of his divine character, rather than constantly creating anew and making ad hoc readjustments? Elsewhere, Darwin complained about the fact that in the case of natural selection people felt the need to invoke a designer whereas Newton's law of gravity did not ignite such a response. To his friend, the famous geologist Charles Lyell, he wrote: "No astronomer in showing how movements of planets are due to gravity, thinks it necessary to say that the law of gravity was designed that the planets should pursue the courses which they pursue." And then he added: "I cannot believe that there is a bit more interference by the Creator in the construction of each species, than in the course of the planets."⁷ Now, such an understanding might have offered an atypical believer like Darwin an ideal way-out of the conflict between science and faith but for a Catholic, who was bound to the teachings of the Church, Darwin's attempt would have been less than satisfactory. In particular, Darwin's solution implied that the human mind was produced by a blind, natural process. It therefore did not directly derive from a divine origin and it required no special intervention on behalf of the creator. In order to save these essential tenets of the faith, catholic evolutionists consistently made an exception for the origin of the human soul (Artigas, et al., 2006). Although most of them were bold enough to discuss the evolution of the human body,

⁷ Darwin Correspondence Project Database. <http://www.darwinproject.ac.uk/entry-2833/> (letter no. 2833; accessed 7 September 2010)

none went as far as to suggest evolutionary origins for our mental life. Further, in accordance with the prevailing philosophy of Neo-Thomism, evolution was regarded a teleological process, with a divine intelligence determining its track. God's role in creation had to be more active than Darwin imagined. And finally, Catholic evolutionists were careful to present their reconciling efforts as provisory theories. The truth of the evolutionary hypothesis, they conceded, was far from established. By observing these particular rules, Catholic evolutionists thought they did not transgress the borders of orthodoxy.

This restricted evolutionism only developed after Catholic intellectuals became sufficiently informed about evolutionary science. They had to understand how it worked and what it entailed if they were to comment on it. Once they were convinced of the fact of evolution, they realized that, if Catholics were ever to embrace the new science, they had to detract evolution from the hands of materialists and atheists. Ironically, the Church itself had promoted science education to counteract the imperialist claims its ideological enemies had laid on science. If Catholics were to argue on a par with their opponents, they had to become more scientifically literate. After all, the Church had nothing to fear: truth could never contradict truth, and therefore, true science had to be in line with Catholic faith. Catholic universities were raised, scientific organizations were founded and scientific journals established. But, wherever this occurred and the Catholic intelligentsia indeed became more informed, evolution inevitably made its entrance into their ideas and the tension between Catholicism and evolution was perceived as less threatening.

This effect of science education on the acceptance of evolution by Catholics can be traced through several historical examples. First, between 1888 and 1900, there were five international conferences where catholic scientists not only presented their own work, but also discussed the latest scientific findings in general. One of the issues involved was, of course, evolution. At the first conference in Paris, a proposition was put forward in the anthropology section to declare that evolution ran counter to faith and scripture. This motion was not accepted, but the motivations for that rejection still disclosed a somewhat prudent attitude towards evolution. It was considered a useful hypothesis that should be freely discussed. Six years later, at the third conference in 1894, held in Brussels, catholic scientists felt more confident about the status of evolution and accepted a declaration that sought to actively promote the study of evolution. By the fifth and last conference, in 1900, Catholic scientists took evolution for granted; the issue was not even considered worth a discussion anymore (Paul, 1988). The best scientifically informed Catholics now fully endorsed evolution.

Second, the impact of education becomes all the more apparent, when we compare the situation in Belgium and the Netherlands. In Belgium, the *Société scientifique de Bruxelles* was founded in 1875⁸. Consequently, two journals were published, the *Annales de la société scientifique de Bruxelles* in 1875 and the widely read *Revue des questions scientifiques* in 1877. What is certainly remarkable is that Jesuits were deeply involved in these developments: Ignace Carbonelle had taken the initiative in founding the *Société*, and shortly thereafter, his colleagues would take the lead in the *Société* in defending the possibility of Catholic evolutionism in Belgium (De Bont, 2008a, pp. 51, 135). Eventually, around 1900, this positive attitude towards evolution took root in the Catholic University of Louvain, where a group of progressive intellectuals supported the compatibility of faith and evolution, both in their lectures and their publications. Some even defended their evolutionism through popular addresses, thus introducing evolution to a wider audience and promoting its dissemination. By the 1930s, evolution was widely accepted by Belgian catholic intellectuals (De Bont, 2008a, 2008b). In the Netherlands, however, before 1900, Catholics preferred to protect themselves and their community from the perceived threats of modern science. The *Society for the Advancement of Science among Catholics* was only founded in 1904, almost thirty years after the *Société* in Brussels. The first Dutch Catholic university was only established in 1923 in Nijmegen containing faculties of Theology, Arts and Law, but not of Science. As a result, the introduction of evolutionary thought into Dutch catholic circles proved more difficult than in Belgium and opposition to evolution abated very slowly, lasting into the 1950s(Flipse, 2008, in press-a).

To sum up, local factors did exert considerable influence on the way Catholics approached and handled the issue of evolution. Questions like who represented or taught evolution, what other ideas was it associated with, in which local debates did it become entrenched, and the level of science education should all be taken into account, leading indeed to a rather complex picture, just like Brooke's analysis suggests. But there is more to be said here. It appears that these factors did not so much steer the Catholic assessment of evolution, but rather that they catalyzed or slowed down a process that, historically, can be discerned among Catholic communities in general. That is that, in the end, the majority of Catholic intellectuals – but certainly not all – gradually came to accept evolution, some even evolution by natural selection, and considered it compatible with their faith. Therefore, we can distract at least one pattern, a pattern of reconciliation, that, as Numbers puts it, simplifies the complexity. Whether this pattern is due to the relatively higher significance of international over

⁸ Before the *Société* was founded, Belgian Catholics in their response to evolutionary theory, went through “a short but meaningful phase in which evolutionary theory was vehemently belittled” (De Bont, 2008b, p. 194)

local factors, to the particular hierarchical structure of the catholic Church or to the inherent character of catholic dogma, is an important question, but one we cannot answer here.

In the end, even the Vatican complied to the pattern. For decades, the Vatican tried to block the dissemination of evolutionary thought among its flock. But, without an official decree in which it condemned evolutionism it could never really put a halt to the flow of increasingly popular writings in which Catholics defended the compatibility of Catholic orthodoxy and evolution. Until 1930, the Church remained skeptical of these attempts, but later, the Vatican started to take on a more lenient attitude, leading up to a first official document discussing evolution in 1950. In the next and final section, we will briefly discuss how the Church eventually and gradually came to terms with evolution.

4.4 Vatican responses to evolutionary theory, 1907-2009

When in 1909, the Belgian Catholic geologist Henri De Dorlodot accepted the invitation to represent the Catholic University of Louvain at the centennial Darwin commemorations in Cambridge, the scientific community interpreted this as a signal that the Catholic world had finally endorsed evolutionary theory (De Bont, 2008a, p. 265). But this hopeful conclusion was premature, as De Dorlodot would later experience himself. In 1918 he published his volume, *Le darwinisme au point de vue de l'orthodoxie catholique*, in which he boldly asserted that he intended to protect Catholic orthodoxy from the aberration of fixism that had reduced God to a tinkering fool. Evolution was a fact, and Catholics should not be hesitant about accepting it. Even the evolution of the human body was an inescapable, but also orthodox conclusion. This radical book was later translated into English by Ernest Messenger and received a warm welcome in the American catholic press. One commentator even felt that the affirmative attitude taken by De Dorlodot could be understood as reflecting the official position of the Church. But he was dreadfully mistaken. Inevitably, De Dorlodot's book drew the attention of the traditionalists who then urged him to retract the publication. If not, his case would be presented before the Holy Office. De Dorlodot disavowed this offer and his case was condemned by the Holy Office as unorthodox. In the end, however, the "Dorlodot affaire" ended on an "uncomfortable status quo" (De Bont, 2008b, p. 195): on the one hand, De Dorlodot, who died in 1929, never published on the issue of evolution again, but on the other hand, he never officially retracted his work. The fact that De Dorlodot

had gotten away with this without any compensation, indicates that the power of the traditionalists had finally started to wane⁹. After the De Dorlodot affair, in 1926, Teilhard de Chardin, the famous French Jesuit paleontologist, was proscribed by his superiors not to teach and publicize any longer on the issue of evolution and was sent for two years to China. But after this incident, it seemed that the hierarchical power started to grow more tolerant towards evolution. When Messenger published his evolutionary work, *Evolution and theology. The problem of man's origin* (1932), he met with only very little opposition. An odd twenty years later, the message of this book resonated within *Humani Generis* (1950), the encyclical in which pope Pius XII finally addressed the issue of evolution (De Bont, 2008a).

In *Humani Generis*, Pius XII conceded that the evolutionary origin of the human body offers an interesting hypothesis that Catholics can explore. However, the pope hastened to add that the hypothesis was far from proven. And so he declared:

Some however, rashly transgress this liberty of discussion, when they act as if the origin of the human body from pre-existing and living matter were already completely certain and proved by the facts which have been discovered up to now and by reasoning on those facts, and as if there were nothing in the sources of divine revelation which demands the greatest moderation and caution in this question. (Pius XII, 1950)

These lines illustrate that the Vatican still had difficulties with an evolutionary account of human origins, even after many members of its Church had long come to accept it. It took yet almost another fifty years, before pope John-Paul II in his address to the Pontifical Academy of Sciences on 24 October 1996 would admit that evolutionary theory was “more than a hypothesis”. This had become possible after the Second Vatican had created an environment charitable to the theories of catholic evolutionists, in particular those of the late Teilhard de Chardin, whose writings became highly popular in catholic intellectual circles (Kapusta, 2009). The address was hailed widely as the definite statement of the acceptance of evolution by the Catholic world. However, pope John-Paul II maintained that the human soul could only be explained in terms of “an ontological leap”, so he proved to remain very skeptical towards evolutionary approaches to the human mind (John Paul II, 1996). Even today, many aspects of the modern theory of evolution and its naturalistic implications often remain indigestible for Catholic authorities, spokesmen, and theologians, which they either discard as “philosophy” or as unwarranted extensions to an aggressively asserted, but still controversial (and immoral) theory (Schönborn, 2005, 2007a, 2007b).

⁹ The “Dorlodot affaire” is in full detail discussed by De Bont (2005)

4.5 Conclusions

Today, prominent members of the Catholic Church regularly call for a rational dialogue between science and religion, thereby distancing themselves from the antievolutionism they associate with orthodox and fundamentalist strains of Protestantism. However, evolutionary theory, that explains the biological world in purely natural terms, still forms a formidable stumbling block. The Vatican itself had opposed evolution for almost a century. It did so through a pragmatic policy, dealing with evolutionary writings on a case-to-case basis and by condemning issues like modernism and Americanism it considered entangled with evolution. But, anxious to avoid yet another humiliation after the Galileo affair, the Vatican never officially condemned evolution itself. This prudent *modus operandi* proved insufficient to halt the increasing output of publications that argued for the reconciliation of evolution and catholic faith. The common primary response of Catholics, if they reacted at all, had often been hostile, but, because of its growing attraction and popularity, Catholics gradually grew more and more relaxed with evolution. This process seems to have occurred across different Catholic communities, the pace of which was nevertheless highly influenced by local factors such as the way evolution was presented and the level of science education. In the end, even the Vatican followed the path many members of its flock had long taken before, finally leading up to the tolerant, but ambiguous position it assumes today.

Chapter 5

Creationism in the Netherlands¹

Abstract

Recent events indicate that creationists are becoming increasingly active in the Netherlands. This article offers an overview of these events. First, I discuss the introduction of Intelligent Design (ID) creationism into the Dutch public sphere by a renowned physicist, Cees Dekker. Later, Dekker himself shifted towards a more evolution-friendly position, theistic evolution. Second, we will see how Dekker was followed in this shift by Andries Knevel, who is an important figure within the Dutch evangelical broadcasting group, the *Evangelische Omroep*. His conversion to ID and, consequently, to theistic evolution, brought him into conflict with young-Earth creationists who still strongly identify themselves with the EO. Third, provoked by the ‘dissidence’ of prominent orthodox believers *and* the celebrations surrounding the Darwin year, young-Earth creationists became very visible. After three decades of relative silence, they started a project to make sure that the Dutch people would hear of the so-called ‘alternatives’ to evolutionary theory. This article (1) adds to the alarmingly growing number of reports on creationists’ increased activity in Europe; and (2) suggests that ID, in a context different from the United States, did not unite, but rather divided, the Dutch orthodox protestant community.

¹ This chapter has been previously published in *Zygon. Journal of Religion and Science* (Blancke, 2010).

5.1 Introduction

Creationism and strong anti-evolutionism are often regarded as typically North American phenomena. In the United States, creationists are numerous and very well organized, and they form a considerable political pressure group. However, more and more reports indicate that creationism is dispersing globally, often as the result of missionary work by American creationist groups. In the last three decades, creationism has popped up in Canada, Australia, New Zealand, South Korea (Numbers, 2006), and, last but not least, in Europe (Cornish-Bowden & Cárdenas, 2007; A. Curry, 2009; Kjærgaard, 2008; Numbers, 2006). Germany and Poland are but two examples of European countries that have seen their share of creationist activity (Graebisch, 2006; Kutschera, 2008b). In this article, we will focus on creationism in yet another European country, the Netherlands. Several incidents, both large and small, in the last couple of years indicate that Dutch creationism is a socio-religious phenomenon that cannot be ignored. Here, I will discuss three major events.

First, we will see how Intelligent Design (ID) creationism was introduced into the Dutch public sphere by a renowned physicist, Cees Dekker. Dekker caused a political row, indirectly, in 2005 when the then-Minister of Education, after talking to Dekker, expressed her hope that, eventually, ID might be incorporated into the school curriculum. One year later, however, Dekker himself was gradually shifting towards more evolution-friendly opinions; he was followed in that shift by a well-known media personality, Andries Knevel. This brings us to our second point. Knevel is not an academic, but one of the most important figures within the Dutch evangelical broadcasting group, the *Evangelische Omroep* (EO). The EO created its identity during the 1970s by promoting young-Earth creationism. When Knevel publicly abandoned this belief and embraced ID in 2005, young-Earth creationists were not amused by his conversion. They were even less impressed when, in February 2009, Knevel confessed that he was sorry for having misled his public by promoting both young-Earth creationism *and* ID. By then, young-Earth creationist organizations had become very active, provoked by the impending year of celebration of the work of Charles Darwin in 2009, the bicentenary of the scientist's birth. They had already started an ambitious project to make sure that the Dutch people would hear of the so-called 'alternatives' to evolutionary theory.

5.2 The rise and fall of Intelligent Design: The story of Cees Dekker

5.2.1 Intelligent Design on the way in

In March 2005, ID entered the public arena in the Netherlands. Maria Van der Hoeven, a member of the Christian democratic party CDA, and at that time Minister of Education, Culture and Science, wrote on her weblog that she had had an interesting talk with Cees Dekker, an evangelical and a Dutch scientist with ID sympathies. Dekker still works as a professor at the Delft University of Technology where he specializes in nanotechnology, the manipulation of materials at microscopic level. During the last 10 years, however, he has shifted to single-molecule biophysics. His list of publications is impressive², and in 2003 he was awarded the Spinoza Prize, a high-level scientific, to which the editor of the biological journal *Bionieuws* afterwards objected that “allowing fanatical creationists is a disastrous road to take” and that “Cees Dekker has to get out” (quoted in Smedes, 2005, p. 119).

Van der Hoeven felt very impressed with the way Dekker could combine science with religion, and she confessed that she herself could not believe in ‘chance’. She explained: “What connects Islam, Judaism and Christianity is the idea that there is a Creator, no matter how he is identified. In this, I recognize a possibility to build bridges. This can especially be achieved within academic discussions. If we succeed in uniting scientists adhering to all kinds of faith, then it might even become applied in schools and lessons. People from my administration will talk this through with Dekker, to decide on how we should shape this debate.”³

Two months later, she declared, “It should be understood that evolutionary theory is incomplete and that we are still discovering new things”, and that she hoped to instigate a dialogue between scientists and proponents of ID.⁴ Her proposition, however, was met with severe criticism by both scientists and politicians, leading her to withdraw her plans. Nevertheless, on June 8, 2005, at the release of *Schitterend ongeluk, of sporen van ontwerp? (Glorious accident, or traces of design?)*, a book edited by Cees Dekker, Ronald Meester and René van Woudenberg, Maria van der Hoeven was still very hopeful that

² <http://www.ceesdekker.net/html/publications.html>

³The original blog has been removed from the Internet. Fortunately, the text can be found on several other web sites. One of them is: <http://www.kennislink.nl/web/show?id=132896>.

⁴ See the article in *De Volkskrant*, May 21, 2005:

http://www.volkskrant.nl/den_haag/article198440.ece/Minister_wil_debat_over_evolutie_en_schepping.

she would succeed in organizing a public debate. In her speech at the book release, she expressed her concern with fostering a greater mutual respect among people with different philosophical backgrounds.⁵

The incident drew international attention. The people from the Discovery Institute, the Seattle think tank that promotes ID, were very pleased with the introduction of their ideas in a European country. On his website, *Uncommondescent.com*, William Dembski, one of the primary American ID proponents, proudly announced in May 2005 that “there are further indicators that ID is internationalizing”. He also wrote that he was “aware of a forthcoming multi-contributor edited collection by Dutch scientists focused on turning ID into a full-fledged research program [by which he presumably meant the book mentioned above; see also below]. It’s developments like these which lead me to think that what happens with the school boards and court battles will not be decisive. These ideas have a momentum that no amount of complaining by the Darwinists will stop.”⁶

An article in *Science* asked ironically whether Holland was becoming the Kansas of Europe (Enserink, 2005). Two years later, the incident with Van der Hoeven was mentioned, among many other incidents from all over Europe, in the working documents⁷ that resulted in Resolution 1580, in which the Council of Europe warned against “The dangers of creationism in education”.⁸

On November 17, 2000, Dekker had addressed his doubts concerning the scientific status of evolutionary theory in his inaugural speech⁹. Although Dekker admitted that his own research did not involve Darwinian theory, he nevertheless felt knowledgeable enough to judge that “there is remarkably little scientific support for such an important theory like Darwin’s evolutionary mechanism”.¹⁰ He also claimed that “evolution, defined as the explanation for the origin of life and the origin of biodiversity, is a dogma that, after careful examination, barely has any scientific support. At its best, the evidence is sporadic.”¹¹ As he referred to the works of ID proponents Michael Denton¹², Michael Behe and Phillip Johnson, it is not hard to see where he had retrieved his information. The published speech even reproduces (at page 19) the schematic image of

⁵ <http://www.kennislink.nl/web/show?id=132896>.

⁶ <http://www.uncommondescent.com/education/dutch-cabinet-supports-discussion-of-id/>.

⁷ <http://assembly.coe.int/Main.asp?link=/Documents/WorkingDocs/Doc07/EDOC11375.htm>.

⁸ <http://assembly.coe.int/Main.asp?link=/Documents/AdoptedText/ta07/ERES1580.htm>

⁹ For the American reader: the inaugural speech is a speech marking the beginning of one’s professorship

¹⁰ <http://www.ceesdekker.net/files/oratiespeech.pdf>, 18.

¹¹ <http://www.ceesdekker.net/files/oratiespeech.pdf>, 18.

¹² Michael Denton was once a CSC fellow (Forrest & Gross, 2007[2004]). Today, however, he is no longer listed as such (<http://www.discovery.org/csc/fellows.php>).

a flagellum, the poster-child of the ID movement, which was introduced by Michael Behe in his book, *Darwin's black box*, in 1996.

The same year, on March 24, 2000, there had already been another inaugural address in which Darwinian theory was under attack. The speaker was Ronald Meester, professor at the Department of Mathematics at the VU University Amsterdam.¹³ In his address, he stated that “on a popular level Darwin is still very much alive, but [that] on an academic level, there are many, many doubts”.¹⁴ In a footnote, he, too, refers to Denton's and Behe's works, of which he had learned through the works of the Dutch professor-emeritus Arie Van den Beukel, once a physicist at Delft University of Technology – the same university as Dekker. Van den Beukel had popped up in Dekker's speech as the person who had introduced Dekker to ID. In the early 1990s, Van den Beukel had written two books expressing his views on science and religion. The first, *De dingen hebben hun geheim* (*Things have their secrets*), was published in 1990. In this book, his main concern lay with the “materialism” and “reductionism” of modern science, which, in his view, leave the world without a deeper meaning. However, in his second book, *Met andere ogen* (*With different eyes*), published in 1994, his specifically anti-Darwinian sentiments had grown. Relying heavily on Denton's *Evolution. A theory in crisis* (1985), which he does not mention in his 1990 book, Van den Beukel argued that Darwinian theory lacked any hard evidence and that the theory was adhered to as though it were some kind of faith. In 1997, he wrote the introduction to the Dutch translation of Behe's *Darwin's black box* (Behe, 1997). Van den Beukel can be rightly considered the pioneer of ID in the Netherlands.

These ideas were picked up independently by both Dekker and Meester. At the time of their speeches, neither was aware of the fact that they shared similar views. This changed when, two years later, a piece on ID appeared in *Skepter*, the magazine of the Dutch skeptic group, Skepsis. In this article, journalist Marcel Hulspas called ID a more sophisticated kind of creationism, and he made clear that it definitely was not science. He mentioned the inaugural addresses of Meester and Dekker as indications of the fact that ID did have supporters in the Netherlands (Hulspas, 2002). Meester and Dekker consequently joined forces to write a response. They argued for keeping an open mind towards ID, which they defined as an “alternative concept” that had “a very old history that could be traced all the way back to Aristotle” (Dekker & Meester, 2002, p. 42). To them, equating ID with creationism made no sense because “it is concluded from scientific observations and reasoning that design must be fundamental to the natural reality we experience” (p. 43). They complained that the ‘Darwinian mechanism’ was

¹³ <http://www.cs.vu.nl/~rmeester>; the VU University Amsterdam has distinct orthodox Protestant roots and is not to be confused with the University of Amsterdam, which is a state university.

¹⁴ <http://www.cs.vu.nl/~rmeester/oratievu.pdf>, 18.

still accepted although no evidence supported it, because it fitted in well with a materialist-atheist worldview (p. 44). In turn, their reaction provoked some heavy criticism both in the magazine¹⁵ and other media (Dekker, 2005, p. 61). Eventually, the debate faded out, only to reoccur in 2005. In the meantime, Dekker and Meester were joined by the philosopher René van Woudenberg who, in his inaugural speech at the VU University Amsterdam in 2002, argued that ID was a sensible concept that could easily be combined with ‘chance’ (Dekker, 2005, p. 62; Van Woudenberg, 2002), which he repeated in a book one year later (Van Woudenberg, 2003). Soon they and other Christian scientists were meeting monthly to discuss all kinds of topics relating to science and religion. They called themselves the ‘Baambrugge group’ (Dekker, 2008a, p. 328). Inspired by the ideas that were discussed at these meetings, they started compiling articles that would become the 2005 book on ID, *Schitterend ongeluk of sporen van ontwerp*.

5.2.2 A glorious accident

Although some of the authors who contributed articles did not entirely share the editors’ views on design, this book can easily be considered a Dutch defense of ID. With Dekker authoring three articles, Meester and Van Woudenberg two each, and Van den Beukel one article, the content and tone were strongly anti-Darwinian. In the introduction, they insisted that their defense of ID was inspired only by the power of scientific argument, not by religious prejudice (Dekker, et al., 2005, p. 11). However, once one begins reading the book, one soon sees clearly that they did not derive their arguments from mainstream science. American proponents of ID are quoted throughout the entire book. The arguments against evolutionary theory were directly imported from books by Phillip Johnson, Michael Behe, and William Dembski. Dekker and his companions were either unaware of or were ignoring the fact that by 2005, their arguments against evolutionary theory and for ID had already been entirely demolished by numerous scientists and philosophers in the United States (Forrest & Gross, 2007[2004]; K. R. Miller, 1999; Pennock, 1999, 2001; M. Young & Edis, 2006). Six months after the publication of the book, ID suffered a serious blow in court in the case of *Kitzmiller vs. Dover*, the ‘Dover trial’, when Judge John E. Jones III ruled that the teaching of ID in government school science classes violates the First Amendment of the U. S. Constitution because it is not a scientific but a religious view (Numbers, 2006).

The efforts of Dekker and his co-workers did not pass unnoticed, however. On October 22, 2005, Dekker delivered a talk at a conference in Prague, the capital of the

¹⁵ <http://www.skepsis.nl/id-discussie-2.html>.

Czech Republic. The title of the conference was ‘Darwin and design’¹⁶ and it was organized by Charles and Carole Thaxton. In 1984, Charles Thaxton had co-authored, *The mystery of life’s origin. Reassessing current theories* (Thaxton, et al., 1984), which is now considered, together with Denton’s *Evolution. A theory in crisis*, one of the seminal works of the ID movement (Numbers, 2006, p. 374). On Dembski’s website we read that “Cees Dekker (...) gave a short but well-illustrated presentation on molecular machines”.¹⁷ It appears that he filled in for Michael Behe, who was at that time giving testimony in the Dover trial. Other speakers included Stephen Meyer, Jonathan Wells, Charles Thaxton, and David Berlinski, who are all still closely tied to the Center for Science and Culture (CSC), a subsidiary of the Discovery Institute through which the ID movement operates. Moreover, Meyer is the program director of the CSC¹⁸, so it seems that the conference was indeed very important to them. Since hundreds of people from 18 different nations from all over the world attended the conference¹⁹, the importance that the CSC attached to the conference is not surprising. To Dembski, the Prague conference “clearly demonstrated that the intelligent design controversy is not just an American phenomenon; it opened many doors to colleagues in Europe with whom the ID community will be working extensively in the years to come”.²⁰

In the context of the strategy of importing ID into Europe, the efforts made by Dekker seemed very promising indeed. Even after the Dover trial, Dekker, who knew of the devastating verdict, publicly defended ID. On January 1, 2006, he and Ronald Meester were featured in a program on Dutch national television called *Buitenhof* (VPRO), where they discussed ID with several skeptical Dutch scientists. Dekker maintained that there was a genuine, ongoing scientific debate on whether there are objective criteria for detecting design in biological systems. He found it hard to accept that the information content of a cell was the product of ‘mere chance’. He thought ID was an interesting approach that he wanted to give a fair chance, yet he doubted whether its methods would ever prove successful.²¹

¹⁶ <http://www.darwinanddesign.org/>. Unfortunately, this website is no longer accessible.

¹⁷ <http://www.uncommondescent.com/intelligent-design/not-just-an-american-phenomenon-the-recent-prague-id-conference/>.

¹⁸ <http://www.discovery.org/csc/fellows.php>.

¹⁹ <http://www.discovery.org/a/2974>. This article was not written by someone from the Discovery Institute, but by Ondrej Hejma for Associated Press. In reaction to this article, William Dembski wrote his own report of the conference, cited in notes 16 and 19.

²⁰ <http://www.uncommondescent.com/intelligent-design/not-just-an-american-phenomenon-the-recent-prague-id-conference>.

²¹ <http://www.vpro.nl/programma/buitenhof/afleveringen/25203667/media/25781280/?bw=bb&player=wmp&media=25781280&referrnr=&hostname=www&portalid=programmasites&x=63&y=14>.

5.2.3 But is it science?

Two months later, on February 28, 2006, in yet another television show, *Het elfde uur* (broadcast by the evangelical group, EO; see below), Dekker declared that he could not discern any conflict between science and religion. In his eyes, there only existed a cultural conflict between the atheistic, secular worldview and the theistic, Christian worldview. That was, in short, the message of the article he had written for a brand new book that he had edited with Ronald Meester and René Van Woudenberg, *En God beschikte een worm (And God prepared a worm)* (2006).²² He had released the book only a couple of hours before he went on television, which was the reason he was invited to appear. He was accompanied by Sander van Doorn, a Christian evolutionary biologist and contributing author to the new book, who defended the compatibility of Christian faith with evolutionary theory.²³

It seemed that ID was replaced by a more moderate position. The book, however, reveals a slightly different, more nuanced picture. Although Dekker wrote that “Christians fight for the wrong cause if they fight against evolutionary biology” (Dekker, 2006, p. 363) and that “there is no conflict between faith and science” (p. 362), he certainly used a great deal of material from books by Phillip Johnson, the founder of the ID movement in America. Just like Johnson in *Darwin on trial* (1991) and *Reason in the balance* (1995), Dekker set the naturalistic worldview against the theistic worldview (Dekker, 2006, p. 365; Johnson, 1991, p. 8, 1995, pp. 88, 109). He depicted naturalism as atheism, materialism, scientism, physicalism, modernism, and secular humanism (Dekker, 2006, p. 364; Johnson, 1995, pp. 37,38,40,51-70) and referred to the first verses of the New Testament Gospel of John²⁴ as fundamental to the theistic worldview (Dekker, 2006, p. 369; Johnson, 1995, p. 107). The fact that Dekker had not entirely abandoned ID and was still very much influenced by Johnson’s writings is illustrated by the following passage:

Certain complex cell structures pose great difficulties for the traditional neo-Darwinian scenario. You would expect that alternative explanations would be welcome. For some people however, all questions have been answered a priori by

²² This rather strange title come from a passage in Jonah in the Old Testament. Jonah 4, 7 reads: ‘But as morning dawned the next day God prepared a worm, and it so damaged the plant, that it withered’ (New King James Version): http://www.biblegateway.com/passage/?book_id=39&chapter=4&version=50.

²³ <http://www.eo.nl/programma/hetelfdeuur/2005-2006/page/-/mediaplayer/index.esp?afid=6939276>.

²⁴ John 1, 1-3: ‘In the beginning was the Word, and the Word was with God, and the Word was God. He was in the beginning with God. All things were made through Him, and without Him, nothing was made that was made.’ (New King James Version): http://www.biblegateway.com/passage/?book_id=50&chapter=1&version=50.

the solution that 'Darwin has already explained it'. It is amazing that so many intellectually gifted colleagues, who, as skeptical scientists, are well-trained in critical thinking, find the limited 'standard evidence' for Darwinism (the trivial micro-evolution in Kettlewell's moths, in Darwin's finches on the Galapagos, in bacteria that become resistant against antibiotics) so convincing as evidence for the fact that the formidable diversity of the entire biological world has come about through neo-Darwinian macro-evolution. (Dekker, 2006, pp. 373-374, my translation)

Dekker was not the only author in the book who was still sympathetic to ID. Co-editor Van Woudenberg argued that creation and evolution were indeed compatible, but he also wrote that Denton's *Evolution. A theory in crisis* is "an indispensable book to determine which attitude suited most in approaching evolutionary theory" (Van Woudenberg, 2006, p. 197). In the conclusion of a rather vague article, the other co-editor, Ronald Meester, summarized his position towards evolutionary theory:

I believe that evolution has taken place, but I do not think that we will ever understand how it all could have happened through scientific means. Of course, this does not make me a creationist (...) and it does not make me an Intelligent Design proponent. At some points, the ID movement does some excellent work, and therefore I have defended it at these points. In particular, it is successful in attacking the popular notion that evolutionary biologists only need to fill in some small 'gaps'. There are serious, fundamental problems with a pure Darwinian scenario as an explanation for 'everything', and to point this out is very wise. However, I do not leap to a designer (...). (Meester, 2006, p. 296, my translation)

Not all authors shared these ambivalent feelings. The most straightforward was Van den Beukel, arguing that Michael Behe had convincingly demonstrated that "the origin of some of those (so-called irreducibly complex) mechanisms cannot possibly be explained by the standard mechanism of Darwin (mutation and natural selection), and that the best explanation is that they are the result of Intelligent Design" (Van den Beukel, 2006, p. 205). Although some authors argue in the book for distinct realms for science and religion (e.g. Smedes, 2006), *En God beschikte een worm* was clearly still very much an ID book.

Surprisingly and unexpectedly, however, on April 14, 2006, two months after the release of the book, Dekker distanced himself completely from ID. In an article on the website of *Nederlands Dagblad*, a Dutch Christian newspaper, he said that he was very disappointed in ID's lack of practical application and complained that his name had

become inappropriately associated with it. He stated clearly that he did not adhere to ID, raising the question of what had caused him to change his views so abruptly.²⁵

5.2.4 Intelligent Design on the way out

Dekker now considers himself a theistic evolutionist, someone who accepts evolutionary theory but thinks that God works through evolutionary processes (Dekker, 2008a). Dekker was in part drawn to this position after reading Francis S. Collins' *The language of God* (2006), in which Collins, director of the National Human Genome Research Institute from 1993- 2008, defends the compatibility of science and Christian faith. Dekker showed himself to be very enthusiastic about this book and wrote the foreword of the Dutch translation.²⁶ Theistic evolution, however, is completely rejected by the main proponents of ID. They frequently blame theistic evolutionists for making God utterly redundant. Dembski, for instance, asserts that "within theistic evolution, God is a master of stealth who constantly eludes our best efforts to detect him empirically" (Dembski, 1999, p. 110). To him and other ID advocates, theistic evolution is simply unacceptable. Dekker, however, was no longer one of them.

On October 3, 2007, Dekker's book *Omhoog kijken in Platland (Looking up in Flatland²⁷)* was published, completing the trilogy that had begun in 2005 with *Schitterend ongeluk, of sporen van ontwerp* (Knevel, 2007, p. 328). In his own article, Dekker questioned the increasing importance of technology in human lives because it made no room for the "depth of humanity" (Dekker, 2007, p. 280). He feared that Western culture was turning into a "brave new world", as described by Aldous Huxley in 1932. As a Christian, he accepted the application of technology to cure people, but not to improve them. There was not a single reference to ID, Johnson, Behe, or Dembski. Moreover, ID and the names of any of its American proselytizers were left unmentioned throughout the entire book. *Omhoog kijken in Platland* is intended to show that orthodox Christian faith – orthodox, as in contrast with liberal, modernistic interpretations of Christian faith – can be coherently combined with modern science. The focus is no longer on the tension between creation or design and evolution (Dekker, et al., 2007, pp. 15-16). Only one chapter, written by Pieter Smelik, a Protestant physician, deals with the question of evolutionary theory. Smelik claims to accept the fact of evolution but thinks that the mechanism that drives evolution is still obscure. He writes: "Evolutionary theory

²⁵ <http://www.nd.nl/artikelen/2006/april/14/cees-dekker-ik-ben-geen-id-aanhanger>.

²⁶ The influence of Collins' book on Dekker was pointed out to me by Gert Korthof (email, May 5, 2009).

²⁷ The title refers to the novel by Edward A. Abott from 1884, called *Flatland. A novel of many dimensions* (Dekker, et al., 2007, p. 9). The book can be found on: <http://www.geom.uiuc.edu/~banchoff/Flatland>.

explains adaptive changes (micro-evolution) perfectly well, but it does not make it apprehensible that adaption processes can lead up to an entire new building plan, nor can it (yet) explain the emergence of new genes to create new features” (Smelik, 2007, p. 178). Because *evolution* can mean different things to different people, it is not always easy to determine what people exactly mean when they claim to have accepted it. Smelik describes evolution as “a creating evolution, a dynamic disclosure of reality, inspired (not dictated!) by the divine Mind. The creature becomes creative, enriches itself with stocked information and searches, thus creating itself, a way through history” (2007, p. 179). This might be some form of evolution, but it is certainly not evolutionary theory in any scientific sense.

What did Dekker himself think of evolutionary theory? What did he now accept? From his chapter in the 2007 book it is hard to tell. When he appeared in a television show on October 9, 2007, on the EO to talk about the book, he said that science was a very powerful method to obtain knowledge but that it could not disprove God. He thought that faith and science fitted together beautifully. However, he said not a word concerning his exact stance towards evolutionary theory.²⁸ One year later, in yet a fourth book, *Geleerd en gelovig (Learned and religious)* (2008b), we find a precise formulation of his new position as a theistic evolutionist. He wholly believed that “God was Creator, and that He created through processes of evolution” (Dekker, 2008a, p. 331). To Dekker as a scientist, the evidence for evolution was overwhelming: “For the evolution of life there is all kinds of proof, the fossils, homologies, the geographic distribution of species, and genetics” (2008a, p. 331). Unlike Smelik, Dekker also seemed to have accepted natural selection as a natural law that was initiated by God:

Theistic evolution includes the idea that we investigate nature with the help of science, the human activity in which we use our mind, given to us by our Creator to grasp His creation. Simultaneously, it includes the strong faith that God is the author of those natural laws, that he is truly creator. God is sovereign and almighty and could create in any way He chooses, but he has apparently chosen to create mainly by secondary causes, by processes that we describe by natural laws.” (2008a, p. 333, my translation)

Before the book came out in December 2008, he had already portrayed himself as a theistic evolutionist in two interviews with *Reformatorisch Dagblad*, a newspaper with a very conservative Protestant audience.²⁹ He now thought of Darwin as a “fantastic

²⁸ <http://www.eo.nl/programma/hetelfdeuur/2007-2008/page/-/mediaplayer/index.jsp;jsessionid=331B7E8AE5187799FF9AE73983D962B2.mmbase02?afid=8970397>.

²⁹ The website of *Reformatorisch Dagblad* cannot be consulted on Sundays. When you try to connect to their site, you get the following message: “[We are] Glad that you are interested in refdag.nl, the news site of the

scientist”, who had a “brilliant insight in biology” and “discovered natural laws like natural selection”.³⁰ On January 6, 2009, Dekker took part in an EO discussion program on Dutch national television, together with an atheistic, Darwinian philosopher and a young-Earth creationist. The show was intended as a special edition to kick off the year of Charles Darwin. The host of the show, Andries Knevel, introduced Dekker as a Christian who reconciled God and Darwin. Dekker had come a long way from Intelligent Design.

5.3 Andries Knevel and the Evangelical broadcaster: The struggle over science and Genesis

5.3.1 Knevel and the EO: an introduction

It was not a mere coincidence that Dekker was invited to appear as a theistic evolutionist in Knevel’s show. Knevel and Dekker had known each other for at least a couple of years. Every time Dekker had published a book, Knevel had given him the opportunity to come and talk about it on television.³¹ Knevel had spoken at Dekker’s book release in June 2005³² and acted as a moderator at the release of *Omhoog kijken in Platland* in October 2007. Dekker and Knevel had also worked together on several other projects (Knevel, 2007, pp. 145-147). They seemed to be bound by at least one common interest: how to reconcile their orthodox faith with science. In answering this question, Knevel underwent somewhat the same shift in thinking as Dekker. However, Knevel was

Reformatorsch Dagblad. Today is Sunday. We devote this day especially to the service of God. We consider Sunday to be a day of rest, an assignment by God, a gift for which we can be grateful. That is why today we do not bring our site up to date.’ <http://www.refdag.nl> (only on Sundays, of course).

³⁰<http://www.refdag.nl/artikel/1370585/%26bdquo%3BGenesis+en+evolutie+gaan+goed+samen%26rdquo%3B.html>, and <http://www.refdag.nl/artikel/1370886/Uitleg+Dekker+als+theistisch+evolutionist.html>.

³¹ *Schitterend ongeluk*: http://www.eo.nl/programma/hetelfdeuur/2004-2005/page/Het_Elfde_Uur/episode.esp?episode=5634811; *En God beschikte een worm*: <http://www.eo.nl/programma/hetelfdeuur/2005-2006/page/-/mediaplayer/index.esp?afid=6939276>; *Omhoog kijken in Platland*: <http://www.eo.nl/programma/hetelfdeuur/2007-2008/page/-/mediaplayer/index.esp?sessionid=331B7E8AE5187799FF9AE73983D962B2.mmbase02?afid=8970397>.

³² The program of the presentation on June 8, 2005, can be found on: <http://www.wetenschapsforum.nl/index.php?showtopic=9785>.

in a position very different from Dekker's. Therefore, *his* intellectual transformation generated an entirely different response from an entirely different corner.

Knevel started working for the *Evangelische Omroep* (the EO, the evangelical broadcaster) in 1978. At that time, the EO was still young; it had been broadcasting only since 1970. When Knevel arrived, the EO had just established itself as a medium for orthodox, evangelical Christians. During the two previous decades, these Christians had already developed a strong resentment against evolutionary theory (Flipse, in press-a). One of the issues on which they wanted to have an influence was the literal interpretation of the story of Genesis. In 1977, the EO made a documentary, *Adam of aap?* (Adam or ape?)³³, in which young-Earth creationism was defended with the assistance of the late A. E. Wilder-Smith, a well-known British creationist.³⁴ The same year, the EO also organized a public debate with the title *Schepping of evolutie?* (Creation or evolution?) in the Jaarbeurs Congrescentrum in Utrecht. Three Dutch pro-evolution scientists (an astronomer, a geologist and a biologist) were pitted against three American creationists, Duane Gish being one of them. The debate was later aired on television.³⁵ In his book, *Avonduren* (Evening hours), Knevel recalls this period:

Meanwhile the EO started broadcasting and it was stressed during the seventies that Christian faith exclusively implied a young Earth. (...) The literal reading of Genesis with the numbers of six or ten thousand years became an identification mark for a movement of which the EO was at the core. (...) When I started working for the EO as a freelancer in March 1978, I found myself in the aftermath of that antithetical period – at least concerning that topic – and I immediately felt at home. There was yet another congress with the title *Adam or Ape*, but the climax had already passed. Other issues were setting the agenda (from abortion to nuclear missiles). (...) The theme 'Creation or evolution' was no longer fascinating to me. By then, I thought I had seen it all. That position lasted during the entire eighties. (Knevel, 2007, pp. 226-227, my translation)

Knevel was not the only one who had lost interest in the debate on creationism by the beginning of the 1980s. After the EO had paid so much attention to the defense of young-Earth creationism against both more liberal interpretations of the Bible and evolutionary theory during the 1970s, creationism was no longer an issue. A decade of silence began.³⁶

³³ The text of five of the six episodes can be consulted on: http://users.skynet.be/fa390968/_Adam_aap.doc

³⁴ <http://www.wildersmith.org>.

³⁵ <http://www.kennislink.nl/web/show?id=131881>.

³⁶ <http://www.eo.nl/programma/kerkinbeweging/2004-2005/page/-/mediaplayer/index.esp?afid=6325049>.

5.3.2 Knevel and Intelligent Design

Things started changing in the 1990s. In 1990 and 1994, Arie van den Beukel published his two books in which he introduced ID to many Dutch conservative Christians. His work not only influenced Cees Dekker and Ronald Meester, but also Andries Knevel, who had by then had made a splendid career in the EO, becoming one of its three co-directors in 1993. For Knevel, reading Van den Beukel's books was an awakening that made him aware of other possible positions regarding creation.³⁷ He began acknowledging the evidence for an old Earth and found out through the Internet that many conservative Christians in the United States had no problem with it. They could easily accommodate their faith with an old Earth. The greatest shock for Knevel came when he read Michael Behe's *Darwin's black box*. Knevel realized that there existed respectable alternatives to a young-Earth creationism that neither infringed on Christian faith nor entailed the acceptance of the purely naturalistic account of evolutionary theory. Slowly, his faith in a young Earth started waning as he moved towards ID (Knevel, 2007, pp. 227-228).

However, Knevel was still struggling with this change of heart. By the end of the 1990s, he was asked by the EO to travel to the United States. He took this opportunity to visit some Christian scientists, including several fellows of the Center for Science and Culture, for example, Walter Bradley and William Dembski, to ask them in person how they dealt with these issues. Most of them accepted an old Earth, and Knevel ended up even more confused. His conversion to ID was completed only when he was back in Holland and organized a meeting with several Dutch Christian scientists to discuss the potential role of ID within the EO. At that meeting, one of the participants corrected Knevel on the exact age of the universe and the Earth. Knevel hesitantly had used some imprecise figures, but he was promptly told that the exact numbers were 13.7 billion and 4.5 billion years, respectively. After that remark, Knevel realized that he was no longer a young-Earth creationist:

That day I accepted the so-called results of science. An old Earth and an old universe. That afternoon I left creationism behind and confessed to adhering to Intelligent Design, without knowing exactly what ID stood for. Through the years I had never doubted that God was the creator of heaven and Earth. He has created. The question was how. (Knevel, 2007, p. 230, my translation)

At the presentation of Dekker's *Schitterend ongeluk* on June 8, 2005, Knevel spoke out publicly for ID for the first time. Three days later, in an EO radio program, he argued for

³⁷ <http://www.eo.nl/programma/kerkinbeweging/2004-2005/page/-/mediaplayer/index.esp?afid=6325049>.

a debate between young-Earth creationists and ID proponents. He considered ID to be a beautiful solution to reconcile science with a belief in Genesis. The debate, however, never took place. From the start, young-Earth creationists were not very keen on embracing ID. Koos van Delden, one of the makers of the *Adam of Aap?* documentary, was featured with Knevel in the radio show. Van Delden had not abandoned the literal reading of Genesis at all. Therefore, he thought it foolhardy of Christians to regard ID proponents as allies to their cause. ID proponents omitted a part of the biblical truth, and he found that very inconsistent. He also compared ID to a car without a motor, and therefore a car without much use.³⁸

Soon Knevel learned that ID was perhaps not the beautiful solution that he had first hoped it would be. Instead of reconciling Christian faith with science and “effectively attacking the Darwinian bastion” (Knevel, 2007, p. 231, my translation), ID seemed to engender some serious fractures within Dutch orthodox Christianity. In the United States, Phillip Johnson and his co-workers at the CSC, intended ID to act as a ‘big tent’, embracing both young and old-Earth creationism. That way, ID was supposed to function as a wedge that could split the log of Darwinian naturalism and secular culture (Forrest & Gross, 2007[2004]). In the US, however, many young-Earth creationists objected to ID on theological grounds; in the Netherlands, ID turned out to be an entirely different kind of wedge. While educated Christians, who felt uncomfortable with a young Earth, welcomed ID as an acceptable alternative version of their religious orthodoxy, helping them to combine their faith with scientific evidence, young-Earth creationists did not appreciate their pro-ID efforts. The latter became increasingly worried about the rejection of the literal meaning of Genesis as a first step towards the rejection of the moral authority of the Bible.

At the same time, Knevel noticed that Cees Dekker, who had at first been defending ID, started publicly doubting its scientific merit, calling himself an evolutionary theist. Knevel, who thought highly of Dekker, was very much in doubt again. By 2007, he admitted that he did not yet know what position to take, putting himself somewhere between ID and theistic evolution (Knevel, 2007, p. 237).

5.3.3 Shared anti-evolutionism

An issue about which Knevel felt less hesitant was his resentment of “evolutionism”, “Darwinism”, and “neo-Darwinism” (Knevel, 2007, pp. 198, 227, 235). Knevel genuinely believed that creationists like Michael Behe had come across natural phenomena that

³⁸ <http://www.eo.nl/programma/kerkinbeweging/2004-2005/page/-/mediaplayer/index.esp?aflid=6325049>.

could not be explained by evolutionary theory (pp. 198, 228). He thought, following most American creationists, that the mechanism of random mutation in combination with natural selection could be compared to a tornado whirling through a junkyard, thus creating a fully functioning Boeing 747 (p. 236). Knevel thereby completely negated the creative power of selective retention (Dawkins, 2006 [1986]). It was no wonder that Knevel (2007, p. 237) declared that, for him, “evolution with random mutation and selection does not exist”.

Knevel was certainly not the only person within the EO who rejected evolutionary theory. In 2007, an incident revealed that anti-evolutionary sentiments were still riding high within the evangelical broadcasting organization. On July 27, 2007, Gerdien de Jong, an evolutionary biologist at Utrecht University in the Netherlands, published an article on the weblog of biologist Gert Korthof, *evolutie.blog.com*. In this article she revealed how the EO had systematically and deliberately edited the BBC documentary *The Life of Mammals*, made and presented by David Attenborough. De Jong had carefully compared the DVDs sold by the EO with the original BBC DVDs and had found that the EO had cut out all references to evolution and to periods of millions of years and had altered the commentary in translation. The tenth episode, on humans, in which Attenborough discussed the relatedness of humans with apes, was left out entirely. This was all done without informing the viewers of the changes, an action that De Jong considered to be censorship. The exposé by De Jong was reported to the Algemeen Nederlands Persbureau (General Dutch Press Office) and, consequently, drew a great deal of media attention.³⁹ Henk Hagoort, who had been promoted to director of the EO in March 2006, replacing Knevel and two others (Knevel, 2007, p. 92), responded laconically to the charges. He said that editing documentaries this way was common practice in the world of television, and he was sure that the media storm would soon blow over.⁴⁰

De Jong, however, did not intend to let this affair pass without further actions. At first, neither the BBC nor Attenborough made much of a fuss about the EO's editing the documentaries. In response to their lack of concern, De Jong, together with a colleague from Leiden University, Hans Roskam, organized a petition in which they asked the BBC to demand that the EO at least warn its viewers that the documentaries had been edited to conform to the aims and scope of the EO.⁴¹ The petition was signed by 379 scientists and sent to both the BBC and David Attenborough.⁴² In a radio debate with de Jong, Hagoort explained that the EO had been editing documentaries for decades and that the

³⁹ <http://evolutie.blog.com/2007/07/>.

⁴⁰ <http://www.refdag.nl/artikel/1310752/EO+laconiek+onder+aantijging+censuur.html>.

⁴¹ <http://www.refdag.nl/artikel/1313633/Petitie+biologen+tegen+%22%3BEO-censuur%22%3B.html>;
http://www.trouw.nl/groen/article1675414.ece/Petitie_biologen_tegen_censuur_EO_in_natuurfilms_.html.

⁴² <http://www.refdag.nl/artikel/1316151/BBC+krijgt+honderden+handtekeningen+tegen+censuur.html>.

BBC had been aware of it. Moreover, the logo of the EO was clearly visible so that the viewers knew what to expect, and that certainly was not evolutionary theory. Hagoort bluntly stated that he himself did not believe that humans were descended from apes.⁴³ A couple of days later, David Attenborough responded to the petitioners in a letter, writing that he regretted the changes the EO had made to his documentary.⁴⁴ This letter even received some attention in the British media.⁴⁵ More than a month later, a letter to the organizers of the petition from the BBC acknowledged that the BBC allowed local broadcasters to edit its material. In the case of the EO, however, the BBC had requested that it withdraw the edited *Life of Mammals* DVDs from circulation⁴⁶, which the EO did.⁴⁷ In the meantime, the EO itself had formed a committee to evaluate the incident. This committee advised the EO that it should no longer secretly edit natural history documentaries.⁴⁸

The EO had its reasons for doctoring any material referring to evolution or evolutionary theory. On the occasion of its 40th anniversary in 2007, the EO had conducted a poll of the religious experiences of its almost half a million members⁴⁹. The results, published in April 2007, showed that 61 percent of the respondents (with a 33 percent response rate⁵⁰) believed that God had created the Earth in six 24-hour days. That was 8 percent more than in a poll the EO had conducted ten years before. Another 32 percent believed that God had created the world, but not necessarily in six days. Only 1 percent thought that God had used evolution in order to create life on Earth.⁵¹ This showed that a large proportion of the members of the EO still identified with the young-Earth creationism that the broadcasting group had promoted so intensively three decades earlier. In 2005, Knevel had already recognized that the EO's grassroots support contained a great number of what he called "intuitive creationists", since only 38 percent of the respondents regarded the origin of the world as an important aspect of

⁴³ [http://www.ochtenden.nl/programmas/22955152/afleveringen/32971728/;](http://www.ochtenden.nl/programmas/22955152/afleveringen/32971728/)

[http://evolutie.blog.com/2007/09/24/.](http://evolutie.blog.com/2007/09/24/)

⁴⁴ [http://evolutie.blog.com/2007/10/03/.](http://evolutie.blog.com/2007/10/03/)

⁴⁵ <http://www.telegraph.co.uk/scienceandtechnology/science/sciencenews/3309018/Creationists-rewrite-natural-history.html> and <http://www.timesonline.co.uk/tol/comment/faith/article2598138.ece>.

⁴⁶ <http://home.planet.nl/~gkorthof/blog/brief-BBC-WW-dd-19-Nov-antw.jpg>.

⁴⁷ <http://www.refdag.nl/artikel/1330895/EO+haalt+natuurseriedvd+uit+de+verkoop.html>.

⁴⁸ Email by Gert Korthof, May 5, 2009.

⁴⁹ The Netherlands has a population of 16.4 million people. 20 percent of the Dutch people above the age of twelve consider themselves Protestants (Centraal Bureau voor de Statistiek, 2008). This amounts to about 3 million people. Therefore, more than one out of six is a member of the EO. In 2007, with its half a million members, the EO was the second largest medium network in the Netherlands (today, the EO comes in third).

⁵⁰ <http://www.refdag.nl/artikel/1301282/EO+schuift+geleidelijk+op+naar+het+midden.html>.

⁵¹ http://www.eo.nl/algemeen/darwin/page/EO_leden_over_schepping/articles/article.espijsessionid=DD4911453C292E17C12E9C769D38D164.mmbase01?article=10136630.

their faith.⁵² Later, when he had accepted the scientific evidence for an old Earth, Knevel also expressed his regret – and felt partly to blame – for the fact that in the 1970s, the EO had gone along so enthusiastically with the American young-Earth movement (Knevel, 2007, p. 234). Thirty years later, the effects of these developments still registered. Soon, Knevel would experience these effects personally.

5.3.4 Knevel's heresy

Today, Andries Knevel is no longer a director of the EO, but he is still considered a very prominent, representative figure. This means that when Knevel shares his opinions in public, people tend to think that he speaks for the EO. This is exactly what happened when, on February 3, 2009, on an EO television program, Knevel read a typed statement in which he confessed that he was no longer a young-Earth creationist and that he was sorry for misleading people. His statement read as follows (and the words crossed out here are the ones Knevel crossed out):

1. I used to believe that creation had taken place in 6 times 24 hours and I was a creationist. Not long ago, I believed in Intelligent Design. ~~But not anymore. Now I believe in evolution.~~
2. I recant all my earlier statements and acknowledge that I have led my children and viewers astray along a certain trail. I regret that. ~~And I also regret the part that the EO has played in this in the past.~~
3. I choose for credibility and faith. Therefore, I shall talk openly to everybody to get to the truth. ~~And never believe in or speak of fairytales or pseudo-sciences again.~~
4. Faith and Science do not exclude each other, but keep on reinforcing and questioning one another. Both have their own truth, meaning and credibility.
5. With all my heart, I still believe in God, the creator of heaven and Earth, and Jesus Christ as savior and lord of this world.

In his own handwriting, he added:

6. I find it very peculiar that so many men of learning are religious.
I believe,
Andries Knevel⁵³ [my translation]

He then signed the document on the air and declared: “This is a beautiful statement”.⁵⁴

⁵² <http://www.eo.nl/programma/kerkinbeweging/2004-2005/page/-/mediaplayer/index.esp?afid=6325049>.

⁵³ http://www.trouw.nl/religie-filosofie/article2023282.ece/De_evolutie_van_de_Evangelische_Omroep.html;

Following Dekker, Knevel had moved towards theistic evolution, but, unlike Dekker, Knevel was not an academic. He had become the face of an organization the majority of whose members thought that it supported, or even shared, their creationist beliefs. Unsurprisingly, those members were not amused. They felt insulted by the way Knevel had presented his new convictions as a result of an improved judgement, a step *beyond* young-Earth creationism. Moreover, they could not accept that ‘their’ EO had wandered off the straight path.⁵⁵ The impression that Knevel had spoken on behalf of the EO was reinforced in *Trouw*, a Dutch newspaper, by an article with the title, “EO lets go of creation story”.⁵⁶ Members contacted the EO in great distress, with some threatening to cancel their subscriptions. In a television show on February 5, Arjan Lock, the new director of the EO, tried to ameliorate the situation by insisting that Knevel did not personify the EO.⁵⁷

That same evening, on another TV channel, Bert Dorenbos, who had served for almost 13 years as the director of the EO (1974–1987), called Knevel’s statement an “insult to God” and “an act of aggression”.⁵⁸ Another ex-employee of the EO, Frank van der Zwan, set up a weblog on which he demanded apologies from both Knevel and the EO. First, he urged members to annul their membership if Knevel and the EO did not comply, but after some reprimanding remarks from visitors to his site (“this is grist on the mill of Satan”), he dropped this “unchristian” part.⁵⁹ Van der Zwan nevertheless got what he wanted. On February 14, Knevel apologized on the air for the arrogant way in which he had made his convictions public. He also affirmed that his views were not those of the EO.⁶⁰ He repeated the same message in a open letter that he wrote for *Visie* (*Vision*), the EO magazine.⁶¹ Nevertheless, the damage was done. Also on February 14,

⁵⁴ <http://www.eo.nl/programma/tzaljemaargebeuren/2008-2009/page/-/mediaplayer/index.esp?afid=10216490>.

⁵⁵ <http://www.novatv.nl/page/detail/uitzendingen/6691>.

⁵⁶ http://www.trouw.nl/nieuws/religie-filosofie/article2023282.ece/EO_laet_het_scheppingsverhaal_loos_.html. This title of this page has been altered.

⁵⁷ http://pauwenwitteman.vara.nl/Archief-detail.113.0.html?&no_cache=1&tx_ttnews%5btt_news%5d=2410&tx_ttnews%5bcalendarYear%5d=2009&tx_ttnews%5bcalendarMonth%5d=2&tx_ttnews%5bbackPid%5d=111.

⁵⁸ [http://dewerelddraaitdoor.vara.nl/Uitzendingen-detail.630.0.html?&tx_ttnews\[tt_news\]=4588&tx_ttnews\[month\]=02&tx_ttnews\[year\]=2009&cHash=debcb30e14](http://dewerelddraaitdoor.vara.nl/Uitzendingen-detail.630.0.html?&tx_ttnews[tt_news]=4588&tx_ttnews[month]=02&tx_ttnews[year]=2009&cHash=debcb30e14).

⁵⁹ <http://eoherroep.blogspot.com>. The blog has been removed from the internet and therefore cannot be consulted any longer.

⁶⁰ <http://www.eo.nl/programma/eonl/2008-2009/page/-/mediaplayer/index.esp?afid=10238204>.

⁶¹ http://www.eo.nl/algemeen/homepage/page/Andries_Knevel_schrijft_brief_aan_EO_leden/articles/article.esp?article=10238027.

Bert Dorenbos wrote an open letter in which he resented the path the EO seemed to have taken, directed by people like Dekker and Knevel.⁶² Five days later, Dorenbos advised orthodox Christians to pray and fast during Lent in order to put the EO on the right track again.⁶³ On March 18, a news program reported that the EO was undergoing a great crisis.⁶⁴ Almost one month later, on April 10, Knevel again expressed his regret for signing the statement. He called it a moment of weakness and said that he had never intended to offend sincere creationist believers.⁶⁵

Today, the EO seems entirely divided on the issue of creation. On one hand, most of its members still uphold the young-Earth interpretation that the EO had unanimously favored during the first ten years of its existence. On the other hand, prominent orthodox Christians are looking for a way to maintain their faith and, simultaneously, to accommodate the facts of science, with an old Earth and evolution as its most problematic components. At one point, some of them, like Dekker and Knevel, believed that ID offered them the ideal solution. To them, ID appeared to be a scientifically respectable alternative to young-Earth creationism and a welcome mediator between Christian orthodoxy and science. This honeymoon did not last very long because the scientific deficiency of ID soon became evident; however, the step had been made, and there was no turning back. Young-Earth creationism was no longer an option, and this fact brought people like Knevel into conflict with a young-Earth creationist community that was becoming more and more self-aware (see below). In the Netherlands, ID had indeed worked as a wedge, but not in the way Phillip Johnson and his co-workers of the Center for Science and Culture (CSC) had in mind. In a context different from the United States, the strategy of ID has failed miserably. By easing the transition of prominent creationists to becoming theistic evolutionists, ID had truly become a Dutch wedge.

⁶² <http://www.creatie.info/component/content/article/12-2004-nieuwsbrieven/445-open-brief-de-ee-op-drift-geraakt-door-drs-lp-dorenbos.html>.

⁶³ <http://www.nd.nl/artikelen/2009/februari/19/veertig-dagen-bidden-en-vasten-voor-ee>.

⁶⁴ <http://www.novatv.nl/page/detail/uitzendingen/6806/>.

⁶⁵ <http://player.omroep.nl/?aflID=9245137>.

5.4 Young-Earth creationists unite

By the end of the 1970s, creationists in the Netherlands were confident that their religious views were dominant among orthodox Christians and their organizations. At the same time, they did not feel threatened by any influence from outside the orthodox community, since they could operate freely within the isolation of their own subculture. For almost 30 years, creationism disappeared from the public arena, only to return when creationists started to feel provoked. Suddenly, creationism became very visible again.

Of course, Knevel's statement on television in which he denounced his faith in young-Earth creationism elicited a wave of criticism by more orthodox believers. Knevel later told the press that he and his family had suffered tremendously because of the tone and multitude of responses.⁶⁶ However, by the time Knevel put creationists on the defensive against his 'heresy', they had already become very active once more. In the last two months of 2008, they had been drawn out into public not by theological struggles within the orthodox community, but by the planned year of commemorating the life and work of Charles Darwin. As soon as creationists realized that Darwin and evolutionary theory would be celebrated extensively in 2009, not only within the scientific community but also in the public arena, they initiated projects to counterbalance the impact of these festivities. In this way, they hoped to inform a large audience that there existed an alternative to the purely naturalistic account of 'Darwinism'. One project in particular drew a great deal of media attention.

5.4.1 Distribute the word

By the beginning of November 2008, the first reports on this project appeared in Christian newspapers.⁶⁷ Kees van Helden, the president of the creationist group *Bijbel en Onderwijs* (Bible and Education)⁶⁸, was rallying financial support to print an eight-page pamphlet with the title, *Evolutie of Schepping. Wat geloof jij? (Evolution or creation. What do you believe?)*. Once printed, the document was to be distributed by the postal services to every household in the Netherlands around February 12, 2009, the 200th anniversary of Charles Darwin's birthday. A committee of recommendation, consisting mainly of

⁶⁶ http://www.volkskrant.nl/binnenland/article1175210.ece/Knevel__Het_was_een_heel_zware_tijd.

⁶⁷ <http://www.refdag.nl/artikel/1371834/Huis-aan-huisactie+in+kader+van+Darwinjaar.html>.

⁶⁸ <http://www.bijbelenonderwijs.nl/index.php>.

Protestant vicars, had been assembled⁶⁹, and the project was backed by 30 creationist organizations from both the Netherlands and Belgium.⁷⁰ All information concerning the project could – and still can – be found on the website that was constructed especially for the occasion, www.creatie.info (Blancke, 2009a).

On November 18 and 19, 2008, other newspapers started covering the project⁷¹, but the great breakthrough in media coverage came on November 20, 2008, when one of its supporters, Johan Huibers, appeared on Dutch national television.⁷² Johan Huibers was already well-known in the Netherlands. Two years before, he had finished building an ‘ark’ which, at this writing, he still uses as a traveling exhibition to deliver the word of God.⁷³ Having already welcomed over 300,000 visitors on board, the popular response has encouraged him to build a second, even bigger ark that will allow him to travel overseas. As Huibers is already a well-known creationist, he was the ideal person to introduce the project to a larger audience on television. He described creationism and evolutionism as two kinds of faith but said that only his Christian faith includes an eternal afterlife. Moreover, he believes that a balance should exist between creationism and evolutionary theory in school biology classes so that students can make an informed choice. When the moderator inquired whether there had been any dinosaurs on the ark, Huibers answered: “Only the little ones”.

In December, some students at Utrecht University responded to this sudden outburst of creationist activity by producing and selling stickers that people could put on their mailboxes. The message on the sticker read, “No, creationism – Yes, Darwin”. This way, people could make clear that they did not want to receive the pamphlet. The stickers turned out to be a great success and were sold out by the end of January 2009.⁷⁴ At around the same time, it became clear that the stickers had not been bought in vain. Van Helden had raised sufficient money (but not all that was needed): on January 30 the first pamphlets were rolling off the press.⁷⁵

⁶⁹ <http://www.creatie.info/in-de-media/293-comitevanaanbevelingondersteuntitinitiatief.html>.

Unfortunately, this page is no longer accessible.

⁷⁰ <http://www.creatie.info/in-de-media/386-meewerkende-organisaties.html>.

⁷¹ http://www.volkskrant.nl/wetenschap/article1094941.ece/Plannen_christenen_voor_actie_tegen_Darwin;
<http://www.edestad.nl/page/Inter-nationaal/Geestelijk-leven/Christenen-voeren-actie-tegen.287462.news>.

⁷² [http://pauwenwitteman.vara.nl/Archief-detail.113.0.html?&no_cache=1&no_cache=1&tx_ttnews\[tt_news\]=1969&tx_ttnews\[backPid\]=111&cHash=5b07262dc1](http://pauwenwitteman.vara.nl/Archief-detail.113.0.html?&no_cache=1&no_cache=1&tx_ttnews[tt_news]=1969&tx_ttnews[backPid]=111&cHash=5b07262dc1).

⁷³ <http://www.arkvannoach.com>.

⁷⁴ <http://www.neecreationisme-jadarwin.nl/>.

⁷⁵ <http://www.ad.nl/ad/nl/1012/Binnenland/article/detail/250071/2009/01/30/Brochure-tegen-evolutieleer.dhtml> ;

http://www.nrc.nl/binnenland/article2137332.ece/Nederlanders_krijgen_brochure_tegen_evolutieleer;



Figure 5 Sticker made by Dutch students to protest against the creationist leaflet campaign

The pamphlet, *Evolutie of Schepping*, promises to be “life-saving”. It consists of eight pages, full of colored pictures and drawings, and presents a hodgepodge of American creationist arguments and ideas. The pamphlet characterizes evolutionary theory as a historical science that cannot be proven in principal. One cannot, it asserts, perform repeatable experiments to test explanations for the origin of human beings; one can only try to explain what happened, and these explanations are easily replaced by others. Next, two lines of evidence that support evolutionary theory are discredited. First, the authors repeat the young-Earth creationist claim that the fossil record does not require an evolutionary approach because the different geological strata can just as easily be explained by a worldwide flood (Whitcomb & Morris, 1961). Second, they ‘expose’ Ernst Haeckel’s nineteenth-century drawings of embryos as a fraud, borrowing this debunking of one of the so-called ‘icons of evolution’ from one of CSC’s central leaders, Jonathan Wells (2000, pp. 81-109).⁷⁶ In the end, according to the pamphlet, the preference for evolution or biblical creation is not a matter of evidence but a matter of choice: “You have a choice: to believe what evolutionary theory says about the origin of humans or to believe what the Bible says. Belief in evolutionary theory means that there is no answer to important questions like: Where do I come from? Why am I here? and Where do I go when I die? If we believe in the Bible, then there are indeed answers to these important questions. Then we can know that God has created us out of love and has a plan for our life.”⁷⁷ (my translation)

http://www.telegraaf.nl/binnenland/3130335/_Brochure_tegen_evolutieleer_.html;

<http://video.google.com/videoplay?docid=-2825454305888393406>.

⁷⁶ For a critical analysis of this claim, see Forrest & Gross 2004, 103-106.

⁷⁷ <http://www.creatie.info/books/bookid/3>.

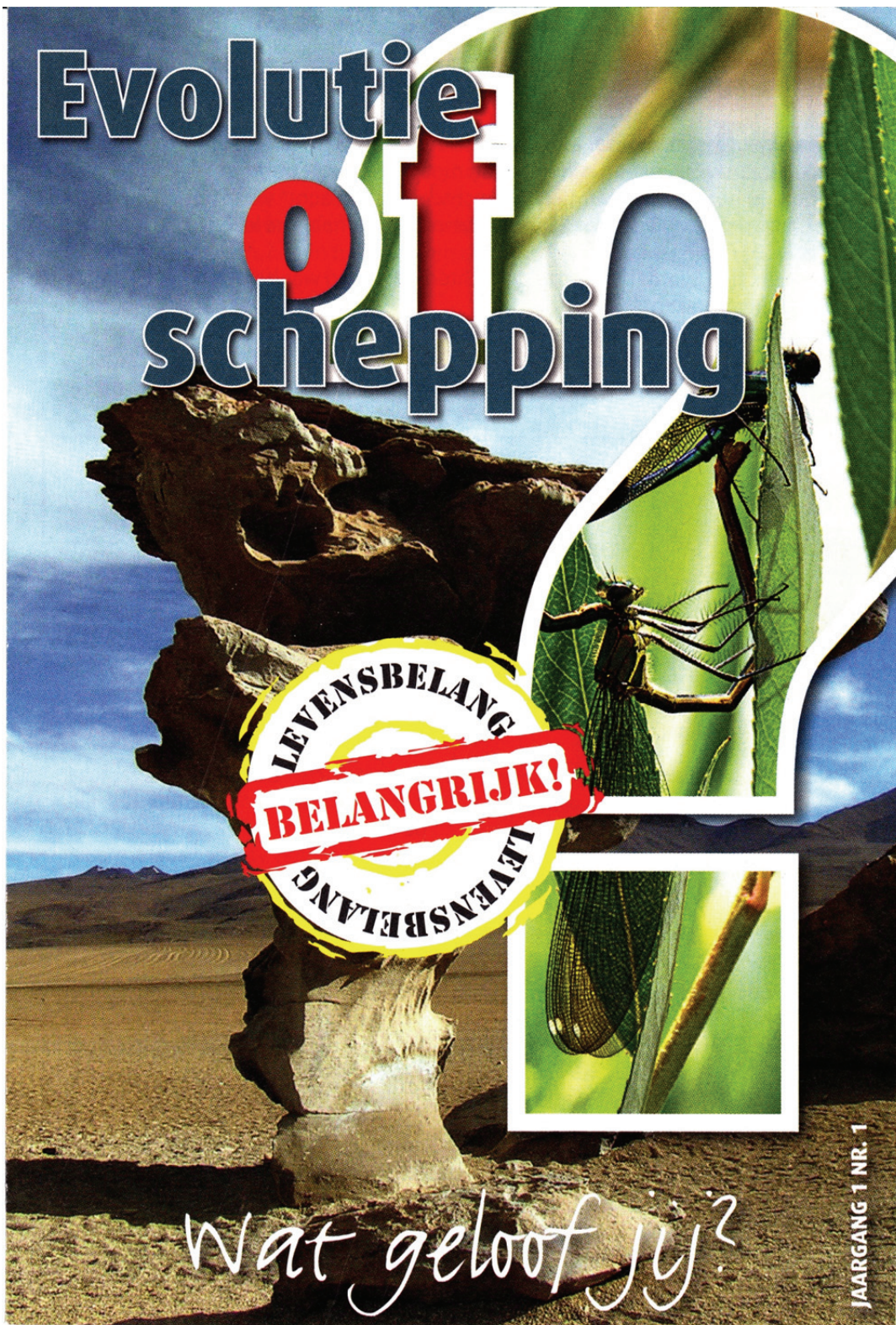


Figure 6 The creationist leaflet “Evolution or creation: what do you believe?”

While waiting for the pamphlets to be distributed, the creationist activists took advantage of the attention given to their project and made appearances in the Dutch national media as often as possible. For instance, on January 6, 2009, Tom Zoutewelle of the creationist organization *Creaton*⁷⁸, was featured in the program by Andries Knevel that kicked off the Darwin year for the EO (see above).⁷⁹ On January 17, Kees van Helden appeared on a radio program in which he debated with Coen Brummer, one of the students behind the sticker campaign.⁸⁰ The upheaval surrounding Andries Knevel's confession on February 3 offered the students the ideal opportunity to participate in the debate and have their voices heard. Kees van Helden was interviewed in a news report on the distress that Knevel had caused among orthodox Christians. At the end of the interview, Van Helden turned to the camera and addressed Knevel directly, saying, "Andries, I hope – and we pray for you – that you will restore your faith in creation as it says in the Bible".⁸¹ Bert Dorenbos, once president of the EO and today president of his own fundamentalist anti-abortion organization *Schreeuw om Leven*⁸² (Cry for life), condemned Knevel's theological turn in a television debate⁸³. On February 12, he handed out 'oersoep' (primeval soup) in the square in front of the Dutch parliament to indicate what is wrong with evolutionary theory.⁸⁴ On February 14, just after having offered his apologies on the radio, Andries Knevel interviewed two young-Earth creationists in his own radio show to demonstrate that he was still willing to listen to their arguments. The two creationists were Jan Rein de Wit of the organization called *Oude Wereld*⁸⁵ (Old World) and Frans Gunnink of *Mediagroep in Genesis*⁸⁶ (Media Group in Genesis), a Dutch spin-off of the large American young-Earth creationist organization, *Answers in Genesis*⁸⁷.

⁷⁸ <http://www.creaton.nl>; *Creaton* is one of the participating organizations in the pamphlet project, see <http://www.creatie.info/in-de-media/386-meewerkende-organisaties.html>.

⁷⁹ <http://www.eo.nl/programma/hetelfdeuur/2008-2009/page/-/mediaplayer/index.esp?aflid=10135815>.

⁸⁰ <http://player.omroep.nl/?aflID=8716214&start=00:31:00>.

⁸¹ <http://www.novatv.nl/page/detail/uitzendingen/6691>.

⁸² <http://www.schreeuwomleven.nl>; *Schreeuw om Leven* is also one of the participating organizations, see <http://www.creatie.info/in-de-media/386-meewerkende-organisaties.html>.

⁸³ [http://dewerelddraaitdoor.vara.nl/Uitzendingen-detail.630.0.html?&tx_ttnews\[tt_news\]=4588&tx_ttnews\[month\]=02&tx_ttnews\[year\]=2009&cHash=debc30e14](http://dewerelddraaitdoor.vara.nl/Uitzendingen-detail.630.0.html?&tx_ttnews[tt_news]=4588&tx_ttnews[month]=02&tx_ttnews[year]=2009&cHash=debc30e14).

⁸⁴ <http://www.refdag.nl/multimedia/397/Schreeuw+om+Leven+serveert+oersoep+in+Den+Haag.html>; <http://www.nd.nl/artikelen/2009/februari/12/waterige-oersoep-van-dorenbos>.

⁸⁵ <http://www.oude-wereld.nl>; *Oude Wereld* also participates in the pamphlet project, see <http://www.creatie.info/in-de-media/386-meewerkende-organisaties.html>.

⁸⁶ <http://www.scheppingofevolucie.nl>; participating organization, see <http://www.creatie.info/in-de-media/386-meewerkende-organisaties.html>.

⁸⁷ <http://www.answersingenesis.org>.

Because of the national media exposure, the project was already a success when finally, on February 19, Van Helden proudly released the pamphlet and personally handed out copies to the people of Urk, his hometown.⁸⁸ On Monday, February 23, the rest of households in the Netherlands received the pamphlet through the postal services.⁸⁹ Not surprisingly, many people were not amused by this creationist enterprise and had set up initiatives to protest against it. One initiative asked people to send the pamphlet back to its maker, Kees van Helden.⁹⁰ Another one was set up by Christians to apologize for the aggressive proselytizing of their fellow believers.⁹¹ Not all responses, however, were that polite. Van Helden began receiving anonymous hate mail in which even his life was threatened.⁹² Van Helden did not understand why his project caused so much distress when people generally did not react in the same manner even to the unsolicited ‘pornography’ (actually, an advertisement for an erotic store) that they sometimes received in the mail.⁹³ Overall, however, Van Helden and his co-organizers were very pleased to attract as much attention as they could.

5.4.2 The aftermath

After almost 30 years of relative silence, the pamphlet project has explicitly put young-Earth creationism back on the Dutch religious map. The discussion about evolution

⁸⁸ <http://www.omroepflevoland.nl/nieuws/recent?NewsKey=C0015919B28BD9A6C1257562003F6381;http://player.omroep.nl/?aflID=8926466&start=00:14:49>.

⁸⁹ http://www.telegraaf.nl/binnenland/3319270/_Scheppingsleer_in_de_bus_.html?p=7,1;
<http://www.depers.nl/binnenland/287232/Scheppingsleer-ter-discussie.html>;
<http://www.dag.nl/opvallend/brochure-scheppingsleer-deurmat-231276>; <http://www.edestad.nl/page/Internationaal/Geestelijk-leven/Brochure-scheppingsleer-op-de-deurmat.325713.news>;
<http://www.brabantsdagblad.nl/algemeen/geestelijkleven/4554650/Brochure-scheppingsleer-op-de-deurmat.ece>; <http://www.parool.nl/parool/nl/266/Religie-en-spiritualiteit/article/detail/181023/2009/02/23/Schepping-op-de-deurmat.dhtml>;
http://www.trouw.nl/nieuws/religie-filosofie/article2037954.ece/Brochure_scheppingsleer_op_de_deurmat.html;
http://www.katholiek nederland.nl/actualiteit/2009/detail_objectID684770_FJaar2009.html.

⁹⁰ <http://www.terugnaarjemaker.nl>.

⁹¹ <http://www.sorryvoorditgebaar.nl>. Unfortunately, this page is no longer accessible.

⁹² <http://www.refdag.nl/artikel/1393935/Man+achter+folder+schepping+met+dood+bedreigd.html>;
http://www.telegraaf.nl/binnenland/3329408/_Maker_anti-darwin_folder_bdreigd_.html?p=1,1; Also some Belgian newspapers and magazines reported this:
<http://www.knack.be/nieuws/europa/doodsbedreiging-voor-creationist/site72-section25-article29882.html>;
<http://www.demorgen.be/dm/nl/990/Buitenland/article/detail/719465/2009/02/24/Nederlander-achter-anti-Darwinfolder-met-dood-bedreigd.dhtml>.

⁹³ <http://www.omroepflevoland.nl/nieuws/recent?NewsKey=C0015919B28BD9A6C1257562003F6381>.

versus creation has not only become a hot topic within the confines of the Dutch orthodox community, but has also found its way to the public sphere. It is no wonder that the organizers consider their project a huge success. In the weeks following the distribution of the pamphlet, Jan Rein de Wit⁹⁴, Frans Gunnink⁹⁵, and Kees van Helden⁹⁶ all expressed their great satisfaction with the response they received. The fact that by March 18 they were still 113,500 euro's short of paying the bill did not seem to bother them. On the contrary, Van Helden felt confident enough to begin pursuing his next goal: obtaining equal time in the school curriculum for both evolutionary theory and creationism.⁹⁷

In the aftermath of the project, various polls have been taken to inquire what the Dutch people actually thought about evolution and creationism. A scientific poll, by Miller, Scott and Okamoto, published in *Science* in 2006, had already revealed that one out of four Dutch people did not accept evolutionary theory (J. D. Miller, et al., 2006). New polls by newspapers have confirmed this number. Two of them indicated that one out of five Dutch people adhered to a young-Earth creationist view.⁹⁸ Another poll even found that one out of four hold those views. That same poll also showed that no less than 42 percent of the Dutch population did not object to rendering equal time in school to both evolutionary theory and creationism.⁹⁹ These results were highly encouraging for Kees van Helden and his collaborators, who have begun setting up a civic initiative to collect 40,000 signatures in support of a claim for equal time, to be sent to the Dutch parliament.¹⁰⁰ With the support of 40, 000 adults, such an initiative can be put on the agenda of the Parliament. Van Helden has never been shy in his effort to incorporate his religious views into the Dutch school curriculum.¹⁰¹ Religious groups in the Netherlands are already granted considerable freedom concerning the school curriculum within their own state-funded schools. There is no problem to teach creationism in orthodox schools, but Van Helden wants creationism discussed in public schools as well. After the

⁹⁴ <http://player.omroep.nl/?afid=9022642>.

⁹⁵ <http://www.radio1.nl/contents/4243-scheppingsfolder-een-succes>.

⁹⁶ <http://www.omroepflevoland.nl/nieuws/nieuwsbericht?NewsID=57800>.

⁹⁷ <http://www.refdag.nl/artikel/1398726/Evolutie+en+schepping+beide+in+biologieonderwijs.html>.

⁹⁸ <http://static.telegraaf.nl/media/090225.onderzoek.pdf>,

http://www.telegraaf.nl/binnenland/3336037/_Een_vijfde_gelooft_niet_in_Darwin_.html?p=4,1;

<http://www.synovate.nl/pdf/EvolutieOfSchepping.pdf>.

⁹⁹ <http://www.teamvier.nl/Marktonderzoek/Folder-Evolutie-of-schepping-vaak-ongelezen-de-prullenbak-in-1-maart-2009.html>. However, only 401 people were interviewed, which is not a very significant number. See also:

http://www.volkskrant.nl/binnenland/article1155886.ece/Debat_over_schepping_ontbrandt_door_folder.

¹⁰⁰ <http://www.omroepflevoland.nl/nieuws/nieuwsbericht?NewsID=57800>.

¹⁰¹ <http://www.bijbelonderwijs.nl/index.php>;

<http://www.destentor.nl/stentortv/regionieuws/article4531441.ece>

success of the pamphlet project, he felt confident enough to promote his plans through political means. Later, however, little was heard of this project.

5.5 Conclusions

Creationism may have been relatively silent in the Netherlands for the last couple of decades, but it clearly is not dead. Within the protective atmosphere of their own communities, churches and organizations, creationists felt relatively safe from disturbing influences. However, both internal disputes and the Darwin-year festivities have provoked them into action. Today, the voices of creationists are ringing very loudly; creationists are even equal time for their views in the curriculum of public schools.

On one hand, young-Earth creationism in the Netherlands seems stronger than ever. On the other hand, however, the strategy of ID to act as a wedge to crack the log of naturalism seems to have failed entirely. In a setting different from the United States, the Netherlands, ID was not regarded a strategy to unite creationists of all kinds and smuggle creationism into schools, but rather as a possible way of reconciling science and Christian faith. This was especially true of some highly educated, prominent orthodox believers who, fed up with the naïve young-Earth creationism of their fellow believers, considered ID to be a religiously valid and scientifically sound alternative. Once they realized that ID had nothing to offer them, they quickly turned away from it toward even more liberal theological stances. By then, ID had caused, or at least had laid bare, a distinct fracture within the orthodox community itself.

5.6 Epilogue

When I first submitted this paper, in July 2009, the Darwin year was nearly half way, so it was to be expected that the young-Earth creationists would continue to make

themselves heard. On July 28, the Belgian newspaper *De Standaard* announced that the creationists were coming, meaning that the creationist leaflet was also to be distributed in Flanders (the Dutch speaking part of Belgium)¹⁰². This news was later denied by *Johannes Multimedia*, another participating organization behind the leaflet campaign, claiming that, instead, they would focus on the distribution of a second folder, *Wat biedt toekomst? Evolutie of schepping?*¹⁰³ (What offers a future? Evolution or creation?) by the end of 2009. On November 20, they presented this new leaflet.¹⁰⁴ In the meanwhile, various young-Earth creationist books have been published not only to address the shortcomings and immoral consequences of evolutionary theory, but also to argue against the heresy of Knevel and other liberal interpreters of the Bible (Hofman, 2009; Wijnands, 2009). One of these books, *95 stellingen tegen evolutie* (95 theses against evolution) (Progenesis, 2009), which is actually a translation from a Swiss book, was promoted by posting the 95 theses by the entrance of the VU University Amsterdam, just like Luther had allegedly posted his theses in 1517.¹⁰⁵ It remains to be seen what the creationists will come up with now the Darwin year is officially over.

¹⁰² <http://www.standaard.be/artikel/detail.aspx?artikelid=9B2D3SHQ&word=creationisten>

¹⁰³ <http://www.creatie.info/books/bookid/21>

¹⁰⁴ http://www.reformatorischemroep.nl/media_archief.html?player=WMP&series_id=5&delivery_id=858&sbmit=Afspelen

¹⁰⁵ http://www.reformatorischemroep.nl/media_archief.html?player=WMP&series_id=5&delivery_id=858&sbmit=Afspelen

Chapter 6

Creationism in the Low countries: a comparative study¹

Abstract

This chapter starts with a review of Dutch creationist activities that have not yet been covered in the previous chapter. Next, I render an overview of how the Darwin year was celebrated in Belgium, and particularly in Flanders. I then discuss some of the reactions of Flemish Catholic opinion makers in response to the Darwin year. Next, I review the incidents and studies relating to creationism and antievolutionism in Belgium over the last ten years. To conclude, I identify some of the factors that might help explain the difference in creationist activism between Flanders and the Netherlands.

¹ Together with the previous chapter, this chapter will deliver the material for a chapter that will appear in: Blancke, Stefaan, Hans Henrik Hjerimitslev and Peter C. Kjærgaard: *The history of creationism in Europe* (Baltimore: The Johns Hopkins University Press) (Blancke, et al., forthcoming). Parts of this paper have been presented at the annual meeting of the Society for the Scientific Study of Religion in Baltimore, Maryland, 29-31 October 2010.

6.1 Introduction

The Darwin year turned out to be a blessing for a scholar studying creationism in the Low Countries. Instead of having to probe for creationists in the evangelical and orthodox reformed communities in the Netherlands, they were suddenly very keen on exposing themselves. They featured in television shows, radio broadcasts, and newspapers, not only in the Netherlands, but also in Belgium where journalists were happy to report the eccentric antievolutionary concerns of the northerly neighbours. However, when the Darwin celebrations passed, and with no provocation to react to, the Dutch creationists soon retreated to their own subculture. Since 2009, except for a couple of noteworthy incidents, they have mostly refrained from seeking a voice and visibility in the public domain. In Belgium, the situation has been entirely different from the start. As in Holland, the Darwin year was celebrated quite intensely by both the academic world and in the public space. However, unlike the Netherlands, these celebrations did not evoke a religiously inspired reaction in which the celebrations or evolutionary theory were targeted. Nevertheless, Belgium has not been completely devoid of antievolutionist sentiments or activities.

This chapter starts with a review of Dutch creationist activities that have not yet been covered in the previous chapter. Next, I render an overview of how the Darwin year was celebrated in Belgium, and particularly in Flanders. I then discuss some of the reactions of Flemish Catholic opinion makers in response to the Darwin year. Next, I review the incidents and studies relating to creationism and antievolutionism in Belgium over the last ten years. To conclude, I identify some of the factors that might help explain the difference in creationist activism between Flanders and the Netherlands.

6.2 Dutch creationist activism since the Darwin year

The second leaflet the Dutch creationists launched by the end of the Darwin year, never got distributed due to a lack of money. Today, in September 2011, the organizers of the

campaign are still € 36,455 short of paying the bill for the first leaflet². However, not all their projects ended with a squib and at least three of them are worth mentioning. Curiously, the young earth creationist organization *De Oude Wereld* or its president Jan Rein De Wit have been involved with all three.

First, in March 2010, the young earth creationists launched the popular “science” magazine called *Weet*.³ (“Know”) With its glossy paper and beautiful coloured pictures, *Weet* convincingly mimics an ordinary science magazine. Its editorial board however is comprised of all the household names of Dutch creationism, including Bert Dorenbos, Frans Gunnink and Koos van Delden (see previous chapter). In his first editorial, the editor-in-chief, Jan Rein De Wit writes that the Bible is at the centre of the issues *Weet* is concerned with: “Not to prove that the Bible is literally true, because that goes without question, but to show the greatness of God.” (*Weet* 2010/1, p. 5, translation by Brummer, 2010) Unsurprisingly, the content offers little more than a reiteration of the same old, long debunked creationist arguments (Brummer, 2010). However, the magazine is still being published and with its 12th issue coming up, continues to be a success.



Figure 7 Cover of the first issue of the Dutch creation science magazine *Weet* (February 2010)

² <http://www.creatie.info/>

³ <http://www.weet-magazine.nl/home>

Secondly, on October 2, 2010, the magazine *Bionieuws*⁴, published by the Dutch Institute for Biology⁵, announced that the creationist bible, *Evolution. Ein kritisches Lehrbuch*, by Reinhard Junker and Siegfried Sherer (see chapter 3) had been translated into Dutch by the secretary of *De Oude Wereld*, biology teacher Kees-Jan Van Dam. Also in the article, evolutionary biologist at University of Utrecht, Gerdien de Jong, expressed her concern as she believed that the content was far too complex for students to understand, let alone to rebut. On October 29, 2010 *De Oude Wereld* had a copy of the book delivered to every university in the Netherlands.⁶ In December 2010, De Jong responded with a critical book review⁷ and in February 2011, she launched a website to inform the public that the book by Junker and Sherer “is not a textbook nor a standard publication in the domain of evolutionary biology and that its content shows little correspondence with current knowledge concerning evolutionary biology.”⁸

Thirdly, in February 2011, *De Oude Wereld*, together with *creatie.info*, breathed new life into the civil initiative Kees van Helden had first talked about after the success of the leaflet campaign in Spring 2009 (see previous chapter and appendix). Its goal is still to collect 40,000 signatures of civilians to have the Dutch Parliament discuss the creationist demand for Fair Science, the Dutch variant of the American balanced treatment demands during the 1980s. The introduction reads:

We, proponents of an honest and transparent handling of data within science, science information and education, call for the INTRODUCTION of FAIR SCIENCE as the leading principle for the practice of science in scientific research, science information and education in the Netherlands.⁹

Again, the creationist initiative was quickly met with a response by students and academics from several Dutch universities. Contacts were made to set up a countermovement, both in the Netherlands and Flanders.¹⁰ However, the initiative soon faded out and so did the countermovement.¹¹

The three incidents above can be considered to be a delayed effect of the Darwin year celebrations in the Netherlands. Indeed, both Darwin’s 200th birthday and 150th anniversary of the publication of *On the Origin of Species*, did not pass unnoticed in the

⁴ <http://www.bionieuws.nl/>

⁵ Het Nederlands Instituut voor Biologie (<http://www.nibi.nl/>)

⁶ http://cms.oude-wereld.nl/index.php?option=com_content&view=article&id=63&Itemid=59

⁷ <http://www.bionieuws.nl/>

⁸ <https://sites.google.com/site/junkerscherer/>

⁹ http://cms.oude-wereld.nl/index.php?option=com_content&view=article&id=85&Itemid=89

¹⁰ Bart Bouwman, personal communication, 28 April 2011.

¹¹ Bart Bouwman, personal communication, 26 September 2011.

Dutch academic world, nor in the public space. The creationists somehow felt provoked by the sudden increase of attention and sympathy for evolutionary ideas in Dutch society and decided to speak up. Today, however, it seems that the heydays of creationist activism are over (for now). With the Darwin year passed, there is nothing to react to.

6.3 Religious responses to the Darwin year in Flanders

In Belgium too, the Darwin year was celebrated in a variety of ways. Throughout the year, universities and scientific organizations organized lecture series and symposia, often with renowned Darwin scholars, philosophers of science and evolutionary scientists invited from abroad¹². Museums in Brussels¹³, Liege¹⁴ and other Belgian cities held special exhibitions devoted to evolution; humanist and other secular organizations celebrated the Darwin year by organizing lecture series¹⁵ and compiled special issues of their magazines¹⁶. In the media too, the Darwin year did not pass unnoticed. A search in the *Mediargus* database which archives the content of the most important Flemish newspapers and magazines, shows that in 2009, “evolutionary theory” is mentioned twice as much as it is in 2008 and 2010 (237 against 119 and 107). A search by the name “Darwin” renders similar results (703 times in 2009, against 340 and 341 in 2008 and 2010 respectively). By the start of the Darwin year, quality newspapers and magazines issued supplements and special editions dedicated to the life and work of Charles Darwin and to evolutionary theory. Television specials¹⁷ and television¹⁸ and radio talk

¹² See, for instance, the Calewaert Chair lectures at the Free University of Brussels (<http://www.vub.ac.be/calewaertleerstoeel/Leerstoel%20Calewaert%202008.pdf>) or the lecture series, “The science of evolution” at the Catholic University of Louvain (http://www.kuleuven.be/nieuws/berichten/2009/pb05_03_2009.html).

¹³ http://www.natuurwetenschappen.be/museum/evolution/evolution_hall

¹⁴ <http://www.lavenir.net/article/detail.aspx?articleid=294959>

¹⁵ For instance, the *Darwin versus God?* lecture series organized by HVV and UVV, the largest Flemish humanist associations, the socialist organization *Massereelfonds* and the universities of Ghent and Antwerp, but also, notably, the pluralist religious organization *Motief*: <http://www.h-vv.be/Darwin-versus-God-Hoe-omgaan-met-wetenschap-en-overlevering>

¹⁶ See the March issue of *UVV-info*:

<http://unievrijzinnigeverenigingen.be/export/sites/default/nl/Publicaties/info/Darwin.pdf>

¹⁷ <http://video.canvas.be/strada-de-galerij-van-de-evolutie-13>

shows¹⁹ joined in with the celebrations, bringing the Darwin year and evolutionary theory straight into the homes of the Belgian households. In September 2009, a co-production between a Dutch (VPRO) and a Belgian (Canvas) broadcaster resulted in a documentary in which the voyage of the Beagle was reconstructed over a period of one year. A large number of Darwin scholars and evolutionary scientist were invited aboard to conduct experiments or talk about their research²⁰.

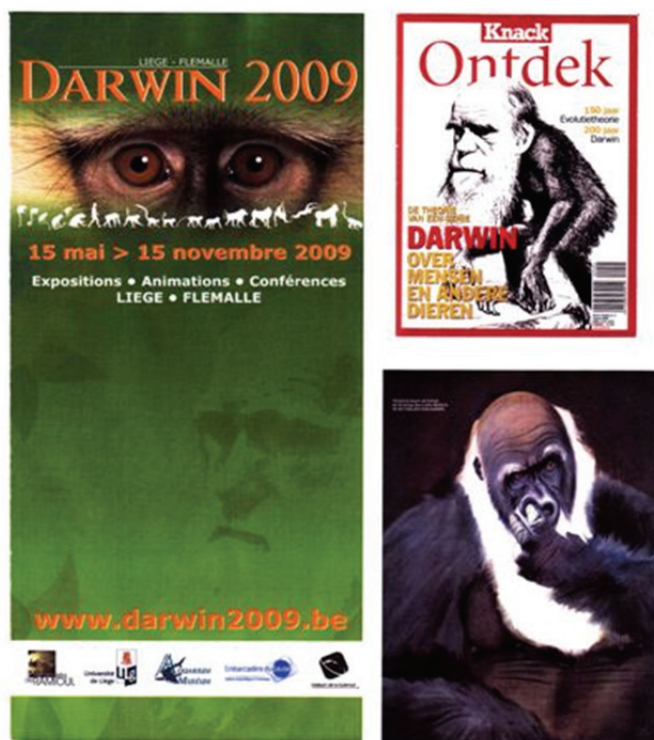


Figure 8 Darwin year in Flanders

None of these happenings, publications or airings caused great agitation in Flemish religious circles. Instead, Catholic representatives and opinion makers considered the Darwin year to be the ideal opportunity to resuming the dialog between science and religion. In *Het Teken*, ('The Sign') a monthly journal published by the Passionist Fathers, Ernest Henau opined that nor religion nor science "should guise itself with the garment of the other. Only then will they be able to engage with a dialogue." He thereby explicitly distanced the position taken by pope John Paul II from the creationist beliefs

¹⁸ <http://www.cobra.be/cm/cobra/cobra-mediaplayer/nog/1.681912>

¹⁹ <http://www.cobra.be/cm/1.681897?view=popupPlayer;>
http://internetradio.vrt.be/radiospeler/v2_prod/wmp.html?qsbrand=11&qsODfile=/media/audio/och1/11_r1_och1_Darwin_120209

²⁰ <http://beagle.vpro.nl/>

of both Protestants in the Netherlands and the US and the “quasi-totality” of the Muslim population. However he also pointed out that a number of proponents of evolutionary theory took a similar fundamentalist ideological attitude.²¹ In *Tertio*, an influential Catholic weekly, the editor Jan De Volder claimed that he did not appreciate creationism or Intelligent Design, because they tend to confuse science with religion. He too believed the time had come for a rational dialogue between science and religion. However, he also felt that Darwinism has become much more than a scientific theory and had turned into an ideology or even a kind of faith that needed proselytizing. Radical Darwinists, he argued without providing any specific names, draw the most horrible moral directives from “natural selection” or “the survival of the fittest” on how to treat the ill and the weak or on how to improve the human species. He also regretted the blurring of the distinction between humans and animals, which he considered a consequence of this radical Darwinism, as he proclaimed: “Is there nothing mysterious and elevated about being human anymore?” He preferred the scientists who were about to engage in a dialogue with theologians and philosophers at a conference in Rome, funded by the Templeton Foundation, to which neither creationist nor “Darwinian ideologues” had been invited.²²

However, despite the fact that they expressed their antipathy about creationism and intelligent design, these authors resorted to a number of creationist arguments. They presented evolutionary theory as some kind of faith and, in one case, ascribed horrible moral implications to it. Later commentaries on the Darwin year by Catholics or in Catholic publications however were more careful. In *Tertio*, Geert Van Coillie believed that creation and evolution can complement one another and argued that “evolutionary theory demonstrates how human freedom was prepared by chance in the prehuman sphere.”²³ In an interview in *Visie* (“Vision”), the weekly magazine of the Christian unions, Taede Smedes stated that the “idea of competition [between science and religion] is theological claptrap. God is the creator of heaven and earth but he is not on the same level with his creation. Hence, religion and science are not connected; they are not competitors.”²⁴ One week later, in an interview in *De Standaard*, cardinal Godfried Danneels, the highest in the Belgian catholic hierarchy, conveyed a similar message. Although he confessed to believe in miracles, such as miraculous healings in Lourdes, he did object to creationism because he had trouble accepting a God who actively intervened in the world. Science and religion should be kept separate, he thought, and

²¹ “Dialoog”, *Het Teken*, vol. 84, May 2009.

²² “Darwinisme tussen wetenschap en geloof”, *Tertio*, 18 February 2009.

²³ “Schepping en evolutie verdiepen elkaar”, *Tertio*, 25 November 2009.

²⁴ “Darwin, het jaar van de waarheid”, *Visie*, 25 September 2009.

he described the relation between them as the tracks of a railway which run parallel to one another but touch in infinity.²⁵

Most upheaval actually occurred one year before the Darwin year started, after the media had reported that Ghent University was investing €200,000 in an outreach and education project about evolutionary theory. The project had first been announced in the January issue of the magazine *Universiteit Gent* in an interview with Johan Braeckman²⁶, the supervisor of the project which was quickly picked up by several Belgian newspapers²⁷. On 30 January, Johan Braeckman explained in *De Standaard* that “Flanders is not the US, where half the population does not accept evolutionary theory. However, that does not mean that we do not need to provide popularly accessible information on such a relevant scientific theory. Increasing the knowledge concerning evolutionary theory is more than worth the effort.”²⁸ However, he also remarked there were some disturbing signals of creationism in Flanders as well. Two days later, a Protestant vicar from Ghent, Johan Temmerman, complained that the “lucrative project” was “not only arrogant, but also unjust”. He argued that it would “enlarge the gap between religious spirituality and science” and that “the initiative of Ghent University embodied a return to the nineteenth-century positivist ideal of the elevation of the human kind by means of reason: by education”.²⁹ One day later, the vicar explained his position on a radio show.³⁰ On 7 February, Taede Smedes, a Dutch theologian working at the Flemish Catholic University of Louvain, described the outreach project in an op-ed as a mini-Nobel prize. He questioned Braeckman’s intentions: was he really only concerned with scientific popularization or did he want to promote an atheist ideology as well? He acknowledged that creationism poses a threat to science and democracy, but he doubted that simply providing more information on evolutionary theory offered a good strategy to deal with creationism. He suggested that if Braeckman wanted a productive dialogue, he would better seek support from theologians “because they speak the language of faith and can clarify the distinction between a religious and scientific perspective and convey it to their religious followers”.³¹ On several occasions, Braeckman defended the project in the newspapers,

²⁵ “Ja, ik geloof in mirakels”, *De Standaard*, 3-4 October 2009.

²⁶ “Darwin voor dummy’s”, *Universiteit Gent*, January 2008.

²⁷ “Gentse professor moet Vlamingen overtuigen van evolutietheorie”, *De Morgen*, 30 January 2008; “Evolutieleer krijgt pr-campagne”, *De Standaard*, 29 January 2008; “Darwin contre le créationnisme”, *Le Soir*, 8 February 2008.

²⁸ “Gevaar van creationisme”, *De Standaard*, 30 January 2008, my translation.

²⁹ “De ware toedracht van het leven”, *De Standaard* 1 February 2008, my translation.

³⁰ http://internetradio.vrt.be/radiospeler/v2_prod/wmp.html?qsbrand=11&qsODfile=/media/audio/onme/11_11_onme_20080202

³¹ “Hoe effectief is het Gentse anti-creationismeproject?”, *De Standaard*, 7 February 2008, my translation.

explaining that the money was nearly sufficient to pay for one employer over a period of four years and that he merely intended to promote a better understanding of evolutionary theory. He also noted that it was a bit expeditious to criticize the project at that point, given the fact that it had only just started.³²

In the meantime, Braeckman had been invited to appear in a talk show on national television to debate Nordine Taouil, an imam from Antwerp.³³ In the course of the debate, the imam stated that he believed that Allah had specially created the human species and that Adam and Eve really existed. He repeated the old creationist conundrum that evolutionary theory is but a hypothesis and maintained that scientists from the United States, Europe and the Arabic world had convincing evidence that proved the theory wrong. When asked for a particular name, Taouil referred to the Turkish creationist Harun Yahya (see chapter 3). He also accused Darwin of being a racist and judged people who reconciled evolutionary theory with their faith to be hypocrites. When asked for a response by a newspaper journalist afterwards, Braeckman found the imam's arguments disturbing, although he was not surprised. He regarded the imam's views as serious instances of creationism and scientific illiteracy which generally impeded the integration of Muslims into society.³⁴

6.4 Political concerns over creationism

When the imam dropped the name of Harun Yahya, it was not the first acquaintance of the Flemish audience with the Turkish creationist. Almost one year before, on 1 March 2007, newspapers reported that in the course of the previous months, the *Atlas of Creation* had been delivered for free to the universities of Ghent, Antwerp and Louvain and to the editorial offices of several Flemish newspapers.³⁵ Several weeks later, news came that secondary schools in Wallonia, the French speaking part of Belgium, had

³² "Communicatie", *De Standaard*, 5 February 2008; "De ware toedracht van een project over wetenschap", *De Standaard*, 5 February 2008; "Smedes", *De Standaard*, 8 February 2008.

³³ <http://www.youtube.com/watch?v=4MMpxIN-TdQ> (part 1) and <http://www.youtube.com/watch?v=LKhG94hIZx4&feature=related> (part 2)

³⁴ "Islamcreationisme bemoeilijkt integratie moslims", *De Standaard*, 4 February 2008; "Blind geloven in de Koran bemoeilijkt integratie", *Het Nieuwsblad*, 4 February 2008.

³⁵ "Wijdverspreid Turks boek geeft Darwin schuld van terrorisme", *De Morgen*, 1 March 2007; "Scholen en universiteiten verrast met Atlas of Creation", *De Standaard*, 1 March 2007.

received unsolicited copies of the *Atlas of Creation*. In response to some disturbing reactions from several schools, Marie Arena, socialist Minister of Education of the French speaking community government, reassured that the views of Harun Yahya are “incompatible with the values that are supported by the educational programs” and that the book should not be considered as a “pedagogical tool”.³⁶ On 8 May 2007, the Flemish Minister of Education in the Flemish Parliament, Frank Van den Broucke, replied to a question posed by liberal MP Magriet Hermans, that to his knowledge the *Atlas* had not been delivered to any Flemish school. He also said that, if the book were to be sent to Flemish schools, he was pretty confident that school managements were competent enough to assess the scientific value of the material offered in the *Atlas* by themselves.³⁷

Three months later, however, newspapers reported that several Flemish schools were receiving copies.³⁸ Moreover, in one newspaper article, the deputy director of a Catholic school thought that “it is a beautiful book with wonderful illustrations. But we have been very busy these last couple of weeks, so we are still undecided as to what we are going to do with it. The religious teachers were certainly interested and are taking the book home during the upcoming Summer holidays. They might use it somehow next year.”³⁹ Consequently, the quote was picked up by Annick De Ridder, another liberal member of the Flemish Parliament, who expressed her concern about the developments following the distribution of the *Atlas of Creation* to the minister of Education. The latter replied that the article was too vague to react upon it, but that, nevertheless, he was going to send a letter to the approved body that was responsible for Catholic education. However, he affirmed that he did not intend to actively interfere with those responsibilities.⁴⁰

Annick De Ridder also referred to the report that had been approved by the Council of Europe on 26 June 2007. Luc Van den Brande, member of the Flemish Parliament for the catholic democratic party CD&V but also head of the Christian fraction in the Council of Europe, corrected this statement. He said that he had the vote over the report delayed. He emphasized that he nor the members of his fraction who resided in the Council of Europe should be considered creationists. He accepted the fact that evolutionary theory was sufficiently supported by evidence to owe its place in the curriculum. However, he felt that this should not prevent religious people from accepting that, beyond evolutionary theory or any scientific dimension, there might

³⁶ “Creationisten bestoken Franstalige scholen”, *Het Nieuwsblad*, 24 March 2007.

³⁷ <http://www.vlaamsparlement.be/Proteus5/showVIVerslag.action?id=491361>

³⁸ “Creationistische bijbel duikt op in Vlaamse scholen”, *Het Volk*, 29 June 2007

³⁹ “Evolutieleer veroorzaakt terrorisme”, *Gazet van Antwerpen*, 30 June 2007, my translation.

⁴⁰ <http://www.vlaamsparlement.be/Proteus5/showJournaalLijn.action?id=497316>

exist a Creator who is responsible for the origin of life. To this, Cathy Berckx, another MP for the CD&V, added that “it is crucial for students to critically engage with whatever material that is presented to them”. She also claimed that “it should not pose any problem to confront pupils with a theory that contradicts evolutionary theory, as long as this happens with the intention of having students critically examine such publications [as the *Atlas of Creation*], depending in part on their knowledge concerning evolutionary theory.”⁴¹

The debate in the Flemish Parliament was entirely ignored by the press, until, more than one month later, a reader of *De Standaard* responded to an op-ed piece by Taede Smedes. Smedes had commented upon the incident in which the EO had doctored BBC documentaries (see the previous chapter), suggesting, in conclusion, that politics should address the censorship imposed by the (partly state-funded) EO.⁴² In his letter, the reader agreed that politics should be concerned with particular aspects of creationism, upon which he referred to the discussion that had taken place in the Flemish Parliament. He wrote that under the guise of the appeal for tolerance towards other opinions and the need to confront pupils with theories that contradict evolutionary theory, both Van den Brande and Berckx were keeping a foot in the door for creationism.⁴³ Five days later, Van den Brande responded to this accusation that he did not question the fact that evolutionary theory should be taught in biology classes. However, he also felt that one could not impinge on people’s belief in a creator or an intelligent being and argued that both views could even complement one another. Outside the science class, it should be possible to discuss adversary opinions because confronting students with a variety of views would result in education of the highest quality. The report that had been discussed in the Council of Europe was too one-sided, he opined, because it suggested that each and every belief in creation posed a danger to democracy and human rights, and therefore should be rejected. That was the reason why he and his fraction had asked to make some changes to the report and proposed to delay the vote.⁴⁴

The discussion turned into a political debate when three days later, Karel De Gucht, liberal minister of Foreign Affairs in the federal government, wrote in an op-ed piece that confronting students with creationism to foster their critical thinking skills concerning evolutionary theory, as both Van den Brande and Berckx had proposed, was comparable to teaching students that babies come from cauliflowers in order to make them think critically about giving birth. Downright rejecting the pseudoscience of

⁴¹ <http://www.vlaamsparlement.be/Proteus5/showJournaalLijn.action?id=497316>

⁴² “De censuur van een creationist”, *De Standaard*, 6 August 2007.

⁴³ “Creationisme”, *De Standaard*, 7 August 2007.

⁴⁴ “Creationisme”, *De Standaard*, 13 August 2007.

creationism would pose no threat to the balance between science and religion. De Gucht acknowledged that views that contradicted evolutionary theory could be discussed in religious classes, as long as it was recognized that science and spirituality belonged to entirely different domains.⁴⁵ Berckx responded that the entire discussion boiled down to a huge misunderstanding.⁴⁶ In an op-ed she explained that she never intended to defend creationism because she realized that it resulted in fundamentalism and extremism. She considered creationism to be a fake science and a fake religion for which there should be no room in the attainment targets of Flemish education. She hoped that her explanation would put an end to the debate, which it did.⁴⁷

When the report concerning the danger of creationism was put on the agenda of the Council of Europe again, Van den Brande and his fraction voted against it. However, not a single newspaper mentioned this event. In December, a statement was published which was signed by more than two hundred Belgian scholars and scientists who were concerned about the fact that one out of three members of the European council had voted against the report, and singled out Luc Van den Brande as one of them.⁴⁸

6.5 Creationism and antievolutionism in Flanders

Did the Belgian scientists and politicians really have much to worry about, except for the imported creationism by Harun Yahya? The conciliatory religious responses to the Darwin year at least confirmed that there did not exist a well-organized activist creationist movement as in Holland. Nonetheless, the fact that small Belgian creationist groups had been involved in the leaflet campaign indicated that Belgium was not entirely free of creationism. But how large is the phenomenon? The study by Miller et al disclosed that one out of five Belgians rejects human evolution, and, according to a recent Ipsos Mori poll, one in ten is a strict creationist (see chapter 3). These numbers are not even as remotely impressive as those in the US. However, they do offer sufficient reason to suspect that, although creationist beliefs have inspired only a small number of Belgians to get involved with antievolutionist activism, there is still a

⁴⁵ “De doos van Darwin”, *De Standaard*, 16 August 2007.

⁴⁶ “Polemiek creationisme in onderwijs”, *De Morgen*, 17 August 2007.

⁴⁷ “Creationisme is verwerpelijk, maar het bestaat”, *De Morgen*, 20 August 2007.

⁴⁸ “De gevaren van het creationisme komen angstwekkend dichtbij”, *De Morgen*, 14 December 2007.

considerable number of people, ranging between 10 and 20 percent of the population who holds these beliefs at a more intuitive level. Generally, these people do not draw a lot of attention to themselves or their religious views, because they tend to operate exclusively within a community of fellow believers or sympathizers. However, occasionally, the media get hold of these creationist sentiments or local activities.

On 7 November 2009, *De Standaard* reported that according to the Belgian state security services, creationism was being taught at Lucerna college, a state-funded free school.⁴⁹ The college, which consists of four secondary schools in three Flemish cities and in Brussels, the capital of Belgium, had been established in 2003 by Turkish traders who were concerned with the educational and professional prospects of immigrant children. In that regard, one of the top priorities of the college is that pupils learn to speak the Dutch language properly. Nevertheless, the college drew the attention of state security because of its alleged ties with the Turkish Gülen movement, an offshoot of the Nur movement that had been deeply involved with the import of American scientific creationism into Turkish education during the 1980s (Edis, 2007, p. 125). Fethullah Gülen, the spiritual leader of the movement, had been forced to move to the US because he had come under the suspicion of the Turkish army that he was promoting an Islamist state. Concerned over the possibility that the Lucerna college was training “little fundamentalists”, the state security had started an investigation. In the end, these concerns turned out to be a bit premature, although there were indications that the college indeed endorsed creationism. The Head responded that evolutionary theory was a compulsory part of the curriculum because of the attainment targets by which the school was bounded. However, witness reports of teachers and the materials used in religious education which the journalist had been able to look into, revealed that evolutionary theory was not a popular subject. In religious classes, the theory was described as “an illogical belief that is not based on any scientific evidence” and tests required pupils to render counter-examples to natural selection.⁵⁰

Previous research had indeed indicated that Muslims living in Belgium had difficulty accepting evolutionary theory. One study that probed for the understanding and acceptance of evolutionary theory by high school and university students in Brussels, showed that one in five students rejected human evolution. Of those twenty percent, most were Muslims (Perbal, 2005). Another study with 200 high school students from several religious backgrounds in Antwerp demonstrated that Catholic adolescents had a lot less trouble accepting the simian ancestry of the human species than their Jewish

⁴⁹ In Flanders, “free schools” are state-funded schools that have been founded by private persons or organizations, traditionally with a Catholic background (although, today, there exist Protestant, Muslim and other free schools as well). (<http://www.ond.vlaanderen.be/gidsvoorouders/notendop/netten.htm>).

⁵⁰ “Integratie- of gettoschool?”, *De Standaard*, 7-8 November 2009.

and Islamic peers (Bogaerts, 2005). In fact, almost all of the Muslim youngsters believed that Allah had created humans, whereas only one in ten Catholic and six in ten Jewish students endorsed this belief. Both studies had been undertaken in the context of a Master thesis and have never been published. However, these numbers do suggest that creationism is highly prevalent in Muslim circles. Moreover, it seems that this situation will not change overnight. Perbal found that the level of instruction had no effect on the acceptance of evolutionary theory by Muslim students. And in the study by Bogaerts, nearly one in two Muslim adolescents claimed that they would not accept human simian ancestry even when the biology teacher would provide evidence for it.

Muslims however are not the only religious people with creationist sympathies in Flanders. In April 2008, Johan Braeckman stated in an interview with *De Standaard* that he had been informed of instances of Catholic and Protestant creationism as well, particularly in elementary schools. At this level, there are no attainment targets that include evolutionary theory, which means that pupils' understanding of the theory cannot be tested. Such a situation creates considerable freedom for teachers who can personally determine how they deal with evolution.⁵¹ More than two years later, in October 2010, *De Standaard* reported that in an evangelical free elementary school in Antwerp, which takes the Bible as the basis of their educational project, questioned evolutionary theory in the classroom. The head of school stated: "In the religious class, we teach the creation story. And in the biology class, we say that we take it for granted that our origins involve God."⁵² Asked for a response, Braeckman told the reporter that he was aware of creationist sympathies in Protestant and Jewish (see below) circles, but that these were only small minorities compared to the Muslim community. He expected that as long as the latter did not find the means to establish their own schools, creationism in Flanders would remain a marginal phenomenon.⁵³ A couple of days later, both a Protestant theologian and a Roman Catholic teacher pointed out in a comment that their faith does not require the bible to be taken literally and allowed them to accept evolutionary theory.⁵⁴ Creationism is not only propagated by Protestant schools, but also within the small evangelical churches that are present in most of the larger Flemish cities. Some of them have been quite active in proselytizing their creationist beliefs, in particular during the Darwin year. The inhabitants of Deinze for instance, a provincial town west of Ghent, received the Dutch leaflet in their mailbox. Members of the local evangelical community had personally distributed them. They also mailed an

⁵¹ "Darwin niet in elke klas", *De Standaard*, 15 April 2008

⁵² "Vraagtekens bij evolutieleer", *De Standaard*, 27 oktober 2010.

⁵³ "God geeft biologieles", *De Standaard*, 28 October 2010.

⁵⁴ "Creationisme spoort niet met Bijbels denken" and "Geen almachtige schepper", *De Standaard*, 3 November 2010.

invitation for a multimedia boat exhibition on the bible and for a lecture on evolution, creation and intelligent design by Jos Philippaerts, the most active creationist in Flanders.

Philippaerts, who holds a PhD in chemistry, was raised a Catholic, but after a conversing experience, he became a member of an evangelical church. Growing ever more skeptical of evolution, he found his antievolutionist beliefs affirmed when attending a talk by David Rosevear, a British creationist of the Creation Science Movement. In 1991, with the assistance of Rosevear, Philippaerts and a number of fellow believers founded Creabel, a young-earth creationist organization with about 300 members. They published a creationist magazine and gave lectures in Baptist, Pentecostal and evangelical churches. Catholic churches were reached through contact with Chris Hollevoet, a Catholic geologist.⁵⁵ By the end of 2008, Creabel appeared on the list of organizations that supported the Dutch creationist leaflet campaign and, today, Philippaerts continues to give lectures on creationism, usually for friendly churches and organizations.⁵⁶ On rare occasions, he is interviewed by media that have a national reach. In a radio interview on the Dutch-speaking national radio with ERTS, the evangelical radio and television foundation, he was allowed to explain his creationist beliefs to a friendly, but small audience.⁵⁷ An interview with *Klasse*, a monthly that is sent to community school teachers, appeared in a skeptical article that also featured Johan Braeckman.⁵⁸ In 2011, Creabel is still active as it celebrates its twentieth anniversary with a two day symposium.⁵⁹

Not only Islamic and evangelical, but also Jewish schools, particularly in Antwerp, have a reputation of promoting creationism. In August 2007, *De Standaard* reported that these schools, some of which are funded by the Flemish community and therefore bounded by the official attainment targets, restricted the teaching of evolutionary theory to a minimum. The representative of the Jewish schools in the education council of Antwerp said that “first, the pupils are being informed of Darwin’s opinion about evolution, but then we give our opinion about creation.” He also felt that there was no need to inform the students that Darwin was wrong, because he thought them quite

⁵⁵ Jos Philippaerts and Rudi Meekers, in an interview with Maarten Boudry and myself, 4 December 2008.

⁵⁶ On one occasion, Philippaerts gave a lecture to the NSV, the Nationalist Student Association that claimed on its website not to be afraid of hearing controversial opinions (see http://www.nsv.be/index.php?option=com_content&view=article&id=226:vorming-over-het-creationisme&catid=1:laatste-nieuws&Itemid=1).

⁵⁷ In Flanders, religious and humanist groups are allowed limited time to broadcast their own television and radio shows which are usually only watched and listened to by members of their own constituency. For the interview with Philippaerts (and Rudi Meekers), see http://www.erts.org/index.php?cat_ID=4&radiotv=135

⁵⁸ <http://www.klasse.be/leraren/archief/13679>

⁵⁹ <http://www.creabel.org/>

capable of knowing by themselves which opinion is the right one.⁶⁰ More than three years later, by the end of October 2010, the newspaper *Gazet van Antwerpen* informed its readers that orthodox Jews were censoring textbooks by striking out even the smallest indication of sex or nudity with a black marker: two grandparents kissing each other, underwear hanging from a clothesline, a woman with uncovered shoulders or navel. Flemish educators who taught at orthodox Jewish schools testified – anonymously, because, allegedly, one teacher had been threatened with his life – that the educational practices were of ancient times and that prehistory and evolutionary theory simply were not mentioned at all. In response, the spokesman of the minister of education, the socialist Pascal Smet, said that most of these schools were private and therefore enjoy considerably more freedom. However, he stressed the fact that the students attending these schools cannot officially graduate unless they take an exam with the Flemish examination commission that is bounded by the attainment targets.⁶¹ One day later, Liesbeth Homans, member of the Flemish Parliament for the N-VA, a Flemish nationalist (but not extreme-right) party, claimed that private schools can be inspected nonetheless. According to her, there were thirteen private schools in Antwerp, of which most were Jewish and which were attended by 2,000 students. But the year before, none of these schools had been properly inspected. As a result, private schools can teach what they want, often to the detriment of the students.⁶²

Except for the usual suspects of Jehovah's witnesses and seventh-day Adventists, who have churches scattered all over the country, there is one more interesting group that tends to foster anti-Darwinian sentiments, the anthroposophy movement. This spiritual cult consists of the followers of Rudolph Steiner, an Austrian philosopher who lived around the turn of the nineteenth and twentieth century. On the basis of Steiner's teachings, the anthroposophy movement has developed an alternative agriculture, medicine and pedagogy. The latter forms the basis for the curriculum of the so-called Steiner schools, which, in Flanders, are state-funded free schools of which there are twenty-five.⁶³ The anthroposophy movement is not creationist in the sense that it stands for a literal interpretation of the Bible. Rather, it promotes a worldview that depends largely on the long discarded biological views of Aristotle and Johann Wolfgang von Goethe and, as such, is distinctly anti-Darwinian. For instance Jos Verhulst, a PhD in chemistry and once teacher at the Steiner school in Antwerp, wrote a book, *Der Erstgeborene*, in which he developed the theory that, from the very start, the realization

⁶⁰ "Creationisme bestaat in joods onderwijs", *De Standaard*, 18-19 August 2007.

⁶¹ "Censuur maakt deel uit van onze opvoeding", *Gazet van Antwerpen*, 27 October 2010; see also "Joodse scholen censureren blote benen", *Het Nieuwsblad*, 28 October 2010.

⁶² "Extra inspecties op scholen hoeven geenszins", *Gazet van Antwerpen*, 28 October 2010.

⁶³ <http://www.steinerscholen.be/>

of the appearance of man had been the ultimate goal of evolution (Blancke, 2004). In March 2009, Verhulst was invited to Ghent by the youth department of the anthroposophical association in Belgium to explain his “broader view” on evolution. In October 2010, he debated Johan Braeckman over evolutionary theory at the largest Steiner school in Ghent, under the title “Are you a monkey?”⁶⁴ However, Steiner schools are bounded by the official attainment targets and there is no evidence that indicates that they actively promote the views of Verhulst and the like. Nevertheless, given the worldview the pedagogical project of these schools is based upon and its general anti-scientific attitude, we cannot expect them to be very concerned with teaching evolutionary theory.

This concludes our review of creationist incidents in Flanders over the last ten years, which clearly shows that creationism at a local level does occur, and probably more often than the media report. However, creationist activism in Flanders is but a minor phenomenon when compared to the situation in the Netherlands. It is striking that two countries that lie so close to each other and that were once part of the same country, display such dissimilar patterns in creationist activities. In the final section of this chapter, I will hint at some explanations that might account for the difference between the two countries.

6.6 Looking for answers

One explanation that immediately springs to mind is the fact that the Netherlands has a distinct Protestant Calvinist tradition, whereas in Flanders Roman Catholicism has for centuries been the main denomination. Protestants have a reputation of taking a firmer stance on the literal interpretation of the Bible. Roman Catholics, on the other hand, are considered to hold more liberal beliefs concerning the historicity of biblical stories and to adhere to more metaphorical readings of the holy book. As a result, Protestants tend to clash more often with the basics of evolutionary theory, whereas Catholics are allowed more space to accommodate their faith with evolutionary theory. Although these generalizations are true to a certain extent, and, to that extent, also explain the difference in creationist activism between the Netherlands and Flanders, they definitely need qualifying. The discussion of Catholic responses to evolutionary theory in chapter

⁶⁴ <http://www.youthsection.org/uploads/media/belgium.pdf>

4 at least shows that the relaxed attitude of Catholics towards evolution today should not be taken for granted; that is, it cannot be understood as a position evidently inherent to the Catholic faith. The Vatican has long struggled with the attempts made by members of its flock to reconcile Catholic dogma with evolution. Even today, the Church has serious difficulty accepting an exclusively natural account of evolution and its implications for our understanding of human thought, behaviour and culture. Furthermore, today, Catholic individuals display a variety of attitudes towards the origin of the biological world and the human species, ranging from strict creationism to a complete acceptance of evolutionary theory. The attitudes also tend to differ regionally. The study by Fulljames and Francis (Fulljames & Francis, 2004) shows that Kenyan Catholics tend to abide by a creationist account, whereas the studies by Bogaert (2005) and Perbal (2005) suggest that Catholic adolescents in Belgium have no problem with accepting human evolution. Also, the Dutch Catholics seem to be more interested in the activities of Intelligent Design proponents than their southern neighbours.⁶⁵

Protestants too have responded to evolution and evolutionary theory in a variety of ways. True, the large antievolutionary movements of the twentieth century took root in white American Protestant circles. However, this does not entail that all Protestants, or even all evangelicals, are committed to creationism. Some denominations hold more creationists within their ranks than others, but commonly the distinction between rejection and acceptance of evolutions runs through and not between denominations (Numbers, 2006). The history of the encounter of the Dutch Calvinist community with evolution reveals a similar pattern⁶⁶.

By the end of the nineteenth century, part of the orthodox Calvinist community (who were dubbed 'neo-Calvinists') increasingly participated in modern culture and academia, which until then had been dominated by liberal Protestants. They developed many initiatives to establish their own organizations, resulting in a strong Calvinist subculture or 'pillar' in the 1920s and 1930s, which was strongly connected to one of the Calvinist, seceded denominations: the 'Reformed Churches in the Netherlands'. Around 1900, when the liberal Protestant culture had long come to accept evolution (Buitenwerf-van der Molen, 2011), two of the leading neo-Calvinists, professors at the Calvinist Free University in Amsterdam, the theologians Abraham Kuyper and Herman Bavinck discussed the issue of evolution. They were quite negative about a general theory of evolution, especially Darwinism, because of its naturalistic, mechanistic and a-teleological character. They were ambiguous, however, about questions of historical

⁶⁵ "Darwinisme is zelf fascinerend probleem", *Katholiek Nieuwsblad*, 14 November 2010; "Katholieke ID-wetenschapper Behe doet Engeland", *Katholiek Nieuwsblad*, 19 November 2010.

⁶⁶ The following history of the encounter of the Dutch Calvinist community with evolutionary theory has been adapted from Flipse (2012)

geology; they did not straightforwardly defend a young earth interpretation. Moreover, they did not explicitly condemn the attempts by fellow believers to reconcile Christian faith with evolution. By the 1920s some Calvinist scientists had come to accept the theory of evolution and others at least suggested that the truth of the theory should be left to science. They were able to reconcile their faith with evolution, usually by following a Reformed Old Testament scholar A. Noordtzij, who, as one of the few Calvinist theologians in this period, interpreted Genesis 1 as a literary construction.

The majority of the second-generation of neo-Calvinist theologians however followed an entirely different path and reduced the debate about the relation of faith to evolution and geology to one issue: the authority of scripture vs. the authority of science. They took a very narrow stance on the interpretation of the relevant passages of the book of Genesis. Some theologians even referred to the 'flood geology' of the seventh day Adventist George McCready Price, long before this 'young-Earth creationism' became popular among Christian fundamentalists in the States during the sixties. Therefore, starting in the 1920s, creationist ideas became an influential undercurrent in Dutch neo-Calvinist thought. The scientists and theologians clashed over these issues and several attempts to reconcile both camps failed. But at that time, theologians had the upper hand in the orthodox community and therefore their opinions prevailed. Due to the strongly organized, closed Calvinist subculture/pillar, it was possible to keep evolutionary theory out of the school curricula of Christian schools. It was only after World War II that this situation changed when the influence of the scientists increased and a new generation of theologians proved themselves to be more open towards the findings of modern science, including evolution. The resulting dialogue between the two parties opened the door for a wider acceptance of the theory of evolution among neo-Calvinists, especially in the 'Reformed Churches in the Netherlands'. By 1960 it had become clear that the elite had embraced the theory and in the early 1970s the discussion over evolution had disappeared almost entirely, which suggests that the orthodox community had made its peace with evolution.

However, other (smaller) Reformed churches continued to resist modernist influences, and even became increasingly conservative now that the largest Calvinist denomination became increasingly liberal. It was in these hotbeds of resistance against liberalizing tendencies, that the resurgent American flood geology took roots in the 1960s. Like in the 1920s, young-earth creationism came to the Netherlands after initiatives by the Dutch themselves and creationism became widespread among the ordinary church members. Nevertheless, none of the smaller orthodox Reformed churches did adopt the promotion of creationism as a self-imposed task. In the 1970s, however, a new movement arose in which conservative Christians from several Reformed Churches and evangelical churches joined forces. This 'evangelical-Reformed' movement did actively promote the dissemination of young-earth creationism, with the EO, the evangelical broadcaster, as its most important organization. The strength of this

network, was that it combined several traditional neo-Calvinist ideas about culture and society with new American-style evangelizing activities. Therefore, the movement was able to become extremely successful in making strict creationism generally accepted by members of several orthodox Reformed Churches and the conservative wing of the Dutch national Reformed Church. The evangelical-Reformed network grew primarily out of discontent with the open attitude of the leaders of the Calvinist pillar towards the wider cultural, political and social changes that took place in the Netherlands. It is therefore not a surprise that most time was spent criticizing the modernizing tendencies within the Calvinist churches, including the acceptance of evolutionary theory. Somewhat thirty-five years later, something comparable happened during the Darwin year. However, then the leaders of the EO themselves were reproached of being captive of modern science, and of renouncing their faith in the Creator (see chapter 5). The history of the encounter between the Dutch Calvinist community and evolutionary theory shows that the acceptance or rejection of evolution is not merely a matter of distinguishing between Catholicism and Protestantism. These do not denote monolithic belief systems that are tied to a particular stance on evolution. Even within the reformed churches that prove to offer fertile soil to American-style creationism, debates have continued up to this day about whether the neo-Calvinist tradition is truly compatible with strict creationism (Flipse, 2011). Other factors certainly have an impact as well. For instance, much seems to depend on how religious authority figures within a community deal with evolution. In the Netherlands, the orthodox theologians of the 1920s wholeheartedly rejected evolution and paved the way for the introduction of Price's flood geology. In Belgium, a small, but influential group of intellectuals at the Catholic university of Louvain, considered evolution not to be at odds with Catholic faith, thus spreading the comfortable message that evolution is not to be feared or opposed by Catholics (see chapter 4). However, what seems most relevant in explaining the difference between the level of creationist activism in Flanders and the Netherlands, is the position of religious groups vis-à-vis secularized mainstream culture. In Flanders, Catholicism, traditionally, has been one of the main players in society, that has however become increasingly, and almost entirely, secularized. Hence, intellectual and spiritual leaders of the Catholic community therefore do not take issue with one of the other main constituents of modern culture, science. Instead, they will be inclined to promote a dialogue between science and religion. The same applies to the Dutch liberal Protestant culture. In the Netherlands, however, religious groups and communities that favour creationism have been able to organize themselves within subcultures the members of which feel no pressure to accommodate their beliefs to the scientific theories that they find disturbing. Such groups also exist in Flanders, but they do not have the means nor the numbers to take a stance. However, in the Netherlands, the reformed-evangelical subculture is sustained by the state through financial support for their schools and the evangelical broadcaster, EO. Despite this support, the state does

not interfere with the organization of the schools or the programs that are being broadcasted. As such, Christians with creationist sympathies can safely remain within their own communities, without ever having to account for their rejection of one of the main theories of modern science. Within such a community, creationist activism is not only easily provoked, but can rely on sufficient supporters to make a stance.

6.7 Conclusions

After the Darwin year, enthusiastic Dutch creationists continued their efforts to oppose evolutionary theory in the public domain and public education. However, with evolution no longer in the spotlights, their activities soon lost momentum. In Flanders, religious responses to the Darwin year called for a rational dialogue between science and religion. However, this does not entail that creationism and antievolutionism does not exist in Flanders. Several incidents reported by the media suggest that, at least at a local level, creationism is being taught in Jewish, Muslim and Protestant schools. But there is no large religious community that explicitly endorses creationism. To a certain extent, the difference between creationist activism and sympathies can be explained by the fact that in the Netherlands was home to a Protestant tradition, whereas in Flanders Roman Catholicism has been the main denomination for a very long time. However, other factors need to be weighed in as well.

Part 2 – Philosophical perspectives

Chapter 7

Simulation of biological evolution under attack, but not really¹

Abstract

The leading Intelligent Design theorist William Dembski (2002) argued that the first No Free Lunch theorem, first formulated by Wolpert and Macready (1997), renders Darwinian evolution impossible. In response, Dembski's critics pointed out that the theorem is irrelevant to biological evolution. Meester (2009) agrees with this conclusion, but still thinks that the theorem does apply to simulations of evolutionary processes. According to Meester, the theorem shows that simulations of Darwinian evolution, as these are typically set in advance by the programmer, are teleological and therefore non-Darwinian. Therefore, Meester argues, they are useless in showing how complex adaptations arise in the universe. Meester uses the term "teleological" inconsistently, however, and we argue that, no matter how we interpret the term, a Darwinian algorithm does not become non-Darwinian by simulation. We show that the NFL theorem is entirely irrelevant to this argument, and conclude that it does not pose a threat to the relevance of simulations of biological evolution.

¹ This chapter has been previously published in *Biology and Philosophy* (Blancke, et al., 2011)

7.1 Background: No Free Lunch and Intelligent Design

In *No Free Lunch. Why specified complexity cannot be purchased without intelligence* (2002), the leading Intelligent Design theorist William Dembski defends the position that the first NFL theorem prohibits the evolution of complex adaptations by Darwinian evolution. This theorem was first published by Wolpert and Macready in 1997, and established that no optimization algorithm can outperform a random search when averaged over all fitness functions. This finding ruled out the possibility of a universal, free-for-all algorithm that outperforms a random search on any fitness function. As a consequence, for an algorithm to perform more successfully than mere chance over a particular fitness function, the algorithm has to be tailored around the fitness function (Wolpert, 2002). From this, Dembski concludes that for natural selection (which can be described as an evolutionary algorithm (Dennett, 1995), itself a kind of optimization algorithm (Wolpert & Macready 1997) to work as it is supposed to do, extra information about the particular fitness function is needed. Dembski thinks that the search for this necessary information is even harder to accomplish than the original search performed by the evolutionary algorithm, which he terms the *displacement problem*. To avoid infinite regress, Dembski believes this extra 'information' can only be supplied by an intelligent designer. The parameters of the environment have to be fine-tuned by this intelligence for natural selection to be successful.

Dembski's book has met with devastating critiques. Some of Dembski's critics (Shallit, 2002; Wolpert, 2002) complained that his writings are so vague that it is almost impossible to pinpoint his actual position. Most critics, however (Häggström, 2007a, 2007b; Orr, 2002; Perakh, 2002, 2003, 2004a; Rosenhouse, 2002; Sarkar, 2007; Wein, 2002a, 2002b), have argued that the NFL theorem is simply irrelevant to biological evolution. Darwinian evolution is the result of natural selection acting over a specific fitness function; biological evolution is simply not concerned with averaging over all fitness functions. This means that, within this particular setting, nothing prevents natural selection from outperforming random search. Therefore, in principle the NFL theorem is applicable to evolutionary algorithms, but in reality it is of little concern.

7.2 Ronald Meester, No Free Lunch and simulations

Ronald Meester, a Dutch mathematician and ID sympathizer², has recently subscribed to that particular critique in this journal: “it is simply not the case that a biological fitness function can be viewed as an average over all possible fitness functions. [...] Therefore the NFL theorem simply does not apply.” (2009, p. 464) However, unlike other critics, Meester believes that the “algorithmic ‘NFL way’ of thinking about evolution is very meaningful when it concerns computer simulations of certain evolutionary processes.”(2009, p. 468)

To illustrate his own position, Meester discusses “two examples of the NFL theorem in action.”(2009, p. 464) Both invoke an algorithm to find a particular target, similar to the well-known ME*THINKS*IT*IS*LIKE*A*WEASEL example by Richard Dawkins (Dawkins, 2006 [1986]). In that model, an algorithm combining random variation and a law of selection is shown to outperform mere chance in targeting this particular sequence from Shakespeare’s *Hamlet* (Meester himself uses the word YES). Now, from the fact that this algorithm does indeed outperform random search, Meester infers:

[the researcher’s] algorithm is too efficient to be the result of averaging over all fitness functions; it is not likely that he chooses his fitness function uniformly at random over all possibilities at the start of each new search. No, it is reasonable to conclude that he uses the fitness function corresponding to the word YES, *and* that he uses the search algorithm associated with that word. Again, note that the conclusion is twofold: we know that he uses special fitness functions and we know that his search algorithm is tailored around his choice in order to get an efficient algorithm. (2009, p. 466)

Meester thinks that this conclusion bears serious consequences for any simulation of the evolution of complex biological adaptations (e.g. Lenski, et al., 2003). The programmer has selected a particular fitness function and a particular algorithm for reaching the target *in advance*. According to Meester, this makes the whole enterprise, including the algorithm, “intrinsically”(p. 468) or “necessarily teleological” (p. 471). No simulation, no matter how sophisticated, escapes this conclusion. Models of biological evolution have been set up in advance by a programmer. He or she selects a particular

² Meester is not an ID proponent as such, because he refuses to infer the existence of a designer. However, he does think that ID, and the concept of irreducible complexity in particular, “poses a serious problem to a Darwinist scenario” (Meester, 2003, p. 152). And he claims that “at some points, the ID movement does an excellent job, and on those points I have defended it. In particular, it successfully attacks the popular idea that evolutionary biology only needs to fill in some small gaps.” (Meester, 2006, p. 296)

fitness function and a particular algorithm (i.e. random mutation and natural selection) to get at a particular goal. According to Meester, this makes the model automatically teleological. Darwinian evolution, by contrast, is non-teleological and undirected. Therefore, computer simulations cannot tell us anything meaningful about the nature of real-world evolution. There are, however, several difficulties with Meester's position that undermine his radical conclusion.

7.3 Difficulties

7.3.1 Setting a target

Meester acknowledges that natural selection can be understood as an algorithmic search procedure (Meester, 2009, p. 464). In evolutionary models it is exactly this algorithm of random variation and natural selection that is simulated. Meester, however, argues that by mimicking this Darwinian, non-teleological algorithm in a computer simulation it all of a sudden ceases to be Darwinian. But why would this be so? The mere fact that we are dealing with a computer simulation instead of a real-life situation is irrelevant, for algorithms are substrate neutral. It does not matter whether an algorithm is implemented in a biological environment or in a silicon-based digital one. As long as the conditions of variation, differential survival and heredity apply, evolution by natural selection will take place, irrespective of the medium (see Dennett, 1995). Thus, by itself, implementing the procedure of random variation and selection into a computer does not alter its non-teleological character.

Meester is ambiguous, however, about the precise meaning of the term "teleological". Throughout the article, he applies it interchangeably and inconsistently to programs, simulations and algorithms and gives it at least two related, but distinct meanings. In one sense, "teleological" applies to the algorithm and means "being aimed at a target". Meester thinks that modeling the algorithm with a preset target, makes the algorithm "intrinsically" teleological and, therefore, non-Darwinian. By contrast, simulations of evolution without such a preset target, for example for modeling bacteria resistance to antibiotics, are deemed unproblematic by Meester. Their point is "not to reach a special target, but instead to compare the 'typical' behavior of related systems." (p. 470) However, simply prefixing the word "intrinsically" to "teleological" obscures his own misunderstanding of the issue. Of course the programmers have a "goal" in mind, but as long as they make sure that the *algorithmic process* itself, in particular the source

of variation, is undirected, this does not affect the validity of the simulation. Moreover, the NFL theorem is silent on the presence of targets; it applies to both kind of simulations or to neither. Either way, the distinction Meester wants to draw between simulations with and simulations without a target cannot be made on the basis of the theorem.

7.3.2 Built with insight into the future?

According to Meester, not just the algorithm but the entire simulation of biological evolution is ‘teleological’ in another sense, as it is built or programmed “with insight into the future” (p. 470) or “the future goal”. Meester argues that programmers always make sure that the search algorithm in a simulation is “very carefully tailored” (p. 469) around particular fitness functions to get at a specific target. Meester’s first objection concerned the presence of a preset target, but what bothers him here is that the simulation is *designed* at all. It is under this notion that Meester thinks he can bring in the NFL-theorem:

So this is the conclusion that is connected to the NFL theorem (I emphasize that this conclusion is not part of the mathematical theorem itself): when a certain algorithm is efficient in combination with a (a class of) fitness function(s), then the algorithm must have been chosen very carefully. (p. 467) (Note that this point is independent from the presence of a ‘target’, which is not even mentioned here by Meester.)

Meester points out that programmers do not chose the fitness functions in the simulation “at random over all possibilities” (p. 466). This is unsurprising, however, because *neither are they in the biological world*. Fitness functions in real life exhibit a significant amount of what Häggström (2007a) terms “clustering properties”, which means that the fitness values of two highly similar DNA sequences are not statistically independent. In particular, “similar DNA sequences will tend to produce similar fitness values” (2007a, p. 228), allowing a search algorithm like natural selection to perform much better than blind chance (Perakh, 2004a). The same point applies to the search algorithm itself, which is only “tailored” in the sense that it is specifically programmed to mirror the *actual* biological search algorithm, i.e. random variation and selection. In fact, what Meester objects to in these simulations is precisely what makes them successful simulations in the first place: they mimic the conditions of real life. Somehow, Meester thinks this only poses a problem for simulations of biological evolution:

I do not claim – of course – that a simulation can only be meaningful if there is no design in the simulation. Indeed, it is impossible to simulate without designing a program. Often this is no problem, but if the whole point of your simulation is to show that complexity can arise in the universe in a Darwinian (and therefore non-teleological) way, then it does become a problem, since then the above discussion applies and shows that any successful computer program must be intrinsically teleological. (p. 471)

Notwithstanding Meester's claim to the contrary, his argument is far too general. It can be raised against simulations of biological evolution *without* a preset target, but also against any simulation or model, of any phenomenon or in any form. If Meester's argument is sound, they would all become 'teleological' and hence unsuited to describe purely natural processes. Weather forecasts, for example, are set up by intelligent humans, which would make them intrinsically teleological and hence useless to talk about real weather phenomena, because the latter are thought of as undirected, natural processes. Unless, of course, there is a designer at work in the real world after all. That is impossible to test, however, because, if Meester is right, models are necessarily and intrinsically teleological. As a consequence, Meester's argument actually immunizes teleology from falsification. Now, given the general implications of his critique, it makes one wonder why Meester singles out simulations of biological evolution as his main target.

7.4 Conclusion

The NFL theorem turns out to be completely irrelevant to Meester's argument against the usefulness of computer simulations of biological evolution. In the end, Meester's point is just that computer simulations are designed, real-life is supposed to be not designed, and therefore simulations cannot be used as models for the real thing. Both the first and the second premise are trivially true, but the conclusion does not follow. A Darwinian algorithm simply does not cease to be Darwinian if simulated in a computer program. By employing the term "teleological" in an incoherent manner and presenting his argument with a mathematical twist, Meester thinks he can work this magic trick. Simulations of biological evolution, however, are in no way threatened by the first NFL theorem.

Chapter 8

Evolved to be irrational? Evolutionary and cognitive foundations of pseudosciences¹

Abstract

In this chapter, we intend to examine how an evolutionary and cognitive perspective might shed some light on the pervasiveness and popularity of irrational beliefs that make up pseudosciences. As such, this contribution will consist of four parts. First, we will set up the general theoretical framework, explaining what an evolutionary and cognitive approach entails. Second, we will explore how this framework adds to our understanding of why the human mind is so vulnerable to systematic reasoning errors. Third, we will demonstrate how concrete pseudosciences tap into particular cognitive dispositions. And, fourth, we will explain why a number of irrational beliefs take on the form of pseudosciences. To conclude, we will turn to the question we have put in our title and briefly discuss how the evolution of the mind relates to human (ir)rationality.

¹ This chapter has been accepted for publication in Pigliucci, Massimo & Maarten Boudry (eds.) *The Philosophy of pseudosciences*. Chicago: Chicago University Press (Blancke & De Smedt, forthcoming).

8.1 Introduction

People believe the weirdest of things. Forty percent of the US population endorses the claim that Earth and all life on it has been created by God six to ten thousand years ago (Newport, 2010); three in four Americans accept some form of paranormal belief such as astrology or extra-sensory perception (D. W. Moore, 2005). Europeans are no less gullible: two Britons in five believe that houses can be haunted and one in five thinks that aliens have visited our planet at some point in the past (Lyons, 2005). Pseudo-medical treatments such as homeopathy are widely practised and in some countries like Belgium even refunded by health care. Horoscopes can be checked in numerous popular magazines and newspapers. In sum, there seems to be no end to the irrational propensities of the human mind.

In this chapter, we intend to examine how an evolutionary and cognitive perspective might shed some light on the pervasiveness and popularity of irrational beliefs that make up pseudosciences. As such, this contribution will consist of four parts. First, we will set up the general theoretical framework, explaining what an evolutionary and cognitive approach entails. Second, we will explore how this framework adds to our understanding of why the human mind is so vulnerable to systematic reasoning errors. Third, we will demonstrate how concrete pseudosciences tap into particular cognitive dispositions. And, fourth, we will explain why a number of irrational beliefs take on the form of pseudosciences. To conclude, we will turn to the question we have put in our title and briefly discuss how the evolution of the mind relates to human (ir)rationality.

8.2 The evolved mind

The idea that the human mind can be regarded as a product of evolution was already proposed by Charles Darwin. In his seminal work, *On the Origin of Species*, in which there is little mention of human evolution, he professed that “psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation” (Darwin, 1859, p. 488). Twelve years later, in the *Descent of Man*, Darwin (1871) argued that humans share particular cognitive faculties with other animals, differing only in degree, which showed that the mind had indeed evolved. But for more than 100 years, despite the enormous potential for explaining human thought and behaviour, and with a few exceptions, Darwin’s radically new approach to the

human mind was largely ignored, notwithstanding a few unsuccessful and premature attempts to darwinize psychology, such as Freudian psychoanalysis. This situation changed during the second half of the previous century with the development of cognitive ethology, sociobiology and evolutionary psychology.

Evolutionary psychology emerged from several scientific traditions, synthesizing elements from research fields such as cognitive science, cognitive ethology and socio-biology (Tooby & Cosmides, 2005), as a consequence of the evidence that had been accumulating in those fields. It challenged the prevailing paradigm in the social sciences, identified by Tooby and Cosmides (Tooby & Cosmides, 1992) and others (e.g. Pinker, 2002) as the Standard Social Science Model, which regards the human mind as a blank slate that can be inscribed with any content culture provides (Pinker, 2002; Tooby & Cosmides, 1992).

Instead, this new evidence suggests that the human mind consists of a number of domain-specific, specialized mental inference systems that evolved in response to specific adaptive problems our ancestors had to solve during their evolutionary history. These were mainly problems dealing with survival, mating and sex, kinship and parenting, and group living (Buss, 2008). One school of thought in evolutionary psychology (e.g. Pinker, 1997) holds that cognitive evolution has not kept pace with cultural developments: the circumstances in which humans live have altered dramatically since the early Holocene (due to, for example, the invention of farming and the Industrial Revolution), but, according to evolutionary psychologists, our evolved mind is still mainly adapted to a hunter-gatherer way of life. Human evolution did not stop in the Pleistocene, as is evident, for example, in mutations in enzymes that allow the digestion of starchy food and dairy products (e.g. Perry, et al., 2007), but evolutionary psychologists (e.g. Tooby & Cosmides, 1992) contend that the pace of cultural evolution over the last 10,000 years has outstripped organic evolution, so that human cognitive adaptations are still to a large extent fitted to a hunter-gatherer lifestyle. There has been some tentative genetic evidence for ongoing cognitive evolution over the past few thousand years (e.g. P. D. Evans, et al., 2005; Mekel-Bobrov, et al., 2005), but these findings have not been without criticism (Currat, et al., 2006; Yu, et al., 2007). The structure of the human mind constrains and governs human thought and behaviour in systematic ways. For example, people are more wary of spiders than of cars, even though the latter category forms a far bigger risk to one's health than the former in most human lives.

What is of interest here is that the mind has been endowed with cognitive dispositions that were adaptive: they offered the ability to produce representations of particular aspects of the world which allowed humans to respond quickly and aptly to specific situations. These predispositions are often pictured as “fast and frugal heuristics” (Gerd Gigerenzer, et al., 1999) that result in intuitive ways of reasoning that are fast, automatic and largely unconscious. To be sure, we do have the feeling that we

have control over our thoughts, that there is an “I” that does the thinking. This reflective way of thinking, which is mostly conscious and functions more slowly in comparison to intuitive reasoning, arises from the human capacity to represent representations. Because this meta-representational capacity does not deal with the outside world directly, it is regarded by some to be domain-general (e.g. Sloman, 1996), although according to Sperber (1996), it can be deemed a cognitive specialization that has evolved specifically to deal with representations. Humans do indeed seem to possess two distinct ways of processing information, intuitive and reflective, also called dual-process reasoning (J. S. B. T. Evans, 2010). As we will see further on, this has important implications for our understanding of human rationality, and thus, for our present discussion of pseudosciences.

8.3 The evolution of cognitive bias

Because the human mind has evolved to deal with adaptive problems in real-life situations, it focuses on specific cues in its environment that are relevant for solving these problems, rather than generating a perfectly accurate picture of the environment. Thus, we can expect human reasoning to exhibit trade-offs between speed and truth-preservation, leading to fast but not always reliable heuristics. This prediction has been borne out by ample studies under the banner of the “heuristics and biases” program, initiated by Tversky and Kahneman in the 1970s (for an overview, see Gilovich, et al., 2002). Even in solving abstract reasoning tasks, people rely on their intuitive judgment (unless taught otherwise), which leaves them highly vulnerable to systematic errors. For instance, when evaluating probabilities, people tend to make judgments on the basis of representativeness (Tversky & Kahneman, 1974). The effect of these heuristics is exemplified by the classical Linda problem (Tversky & Kahneman, 1983). Participants are invited to read the following description: “Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice and participated in anti-nuclear demonstrations.” Then, they are asked which of the two following options they think is the most probable: a) Linda is a bank teller, or b) Linda is a bank teller and a feminist. Although a conjunction can never be more probable than either of its two constituents, around 85% of participants judge that the second option is more likely than the first, arguably because they consider the text to be more representative of a feminist than of

a bank teller. This has been dubbed the “conjunction fallacy.” Fallacies like these have proven to be extremely robust, and not easy to weed out (Tentori, et al., 2004).

Gigerenzer and colleagues (1999) have argued that the appearance of “fallacies” like this does not reflect people’s failure to think rationally, but rather results from researchers appraising people’s reasoning skills by inappropriate standards. To return to the Linda problem, people are supposed to apply a content-free logical rule to arrive at the correct answer. The test however contains ambiguous terms like “probable,” that trigger conversational heuristics that look for intended meaning and relevance, causing subjects to understand the word in non-mathematical terms such as “possible” or “conceivable.” When asked for a frequency judgment (“How many?”) instead of a probability judgment, as a result of which the ambiguity dissolves, people do infer the mathematical meaning, and the conjunction fallacy largely disappears (Hertwig & Gigerenzer, 1999). According to Gigerenzer (2008), variations on experiments like this confirm that the mind should be regarded as a collection of specialized inference systems that have evolved in such a way that the human brain responds to the environment quickly, frugally and rationally.² Hence, according to dual-process theories of reasoning, a picture emerges of two forms of rationality. On the one hand, there is the slow and reflective mode of rationality that conforms to the norms and rules of logic and probability. On the other hand, we have an ecological or bounded rationality that conforms to the adaptive requirements set by the environments in which the human species has evolved (Hilton, 2002). From this perspective, the appearance of irrationality does not result from flawed reasoning, but rather from evaluating the latter form of rationality by the standards of the former. However, when intuitive reasoning is applied to complex and abstract cognitive problems, irrational reasoning can result (Haselton, et al., 2005). Although the fast and frugal heuristics sometimes lead to error, they continue to intervene with people’s reflective inferences, in the form of well-attested kinds of irrationality (see above).

Keeping the above framework in mind, we argue that the tenacity and popularity of particular pseudosciences, even in the face of strong adverse evidence, can partly be explained by the fact that pseudosciences tap into people’s intuitive understanding, thereby exploiting the mental heuristics that have evolved to respond efficiently to particular environmental and social situations. Let us illustrate this point by taking a closer look at one of the most pervasive irrational belief systems of today, creationism.

² However, this view is not widely shared in the psychology of reasoning. For example, Tentori et al. (2004) contend that Gigerenzer’s frequency approach already provides participants with a part of the solution, prompting them to conceptualize the problem in terms of frequencies.

8.4 Pseudoscience and content biases: creationism as a case study

Here, we will use the term “creationism” not in its common sense of Young-Earth creationism, but as a form of belief system that contends that there is evidence that God has purposively intervened in the natural world, creating or designing entities (species, adaptations) that could not have arisen through a naturalistic process. As such, creationism not only denotes Young-Earth creationism, but also includes Old-Earth and Intelligent Design creationism (Matzke, 2010; Scott, 2009). Note that each of these variants is presented as a science by their adherents, or at least considered to be as scientific as evolutionary theory.

Although the various strands of creationism might differ in their theological specifics, our use of the term “creationism” depends on the idea that they share a minimal core of common assumptions. In the rest of this chapter, we will argue in particular that these core assumptions tie in closely with human intuitions concerning the origins and causal structure of the biological world. More specifically, creationism exploits or piggy-backs on the human mind’s essentialism, its preference for teleological explanations and its hyperactive tendency to detect agency. As we will see shortly, each of these intuitions makes sense from an evolutionary perspective.

8.4.1 Psychological essentialism

Essentialism is a hallmark of creationism. It is the view that entities, such as species, possess an immutable essence, which guides their development and behavior. Essentialism can be described as a fast and frugal heuristic that instantly provides our mind with a rich inductive potential, not on the basis of apparent similarities, but on the basis of an unobserved core that is believed to cause members of a given category to share particular behavioral and physical properties. As such, “[essentialism] allows one to exploit the causal structure of the world (of natural kinds, in particular), without necessarily knowing anything about the causes themselves” (H. Clark Barrett, 2001, p. 7). Historically, essentialism constitutes a major and recurrent theme in Western thought at least since Aristotle (Mayr, 1982), a clear indication of its enduring appeal. Today, students’ understanding of evolutionary theory is still hindered by essentialist inclinations (Shtulman & Schulz, 2008): students with the most essentialist tendencies have the least understanding of the mechanism of natural selection. Studies on essentialist reasoning in children indicate that this intuition develops early and in the absence of instruction, and that it is stable across cultures. Five-year-olds acknowledge

that category membership remains unaffected by superficial changes. They consider a butterfly to belong to the same category as a caterpillar despite the dramatic developmental transformations the organism goes through (Gelman, 2003). Also, essentialism is not restricted to Western culture: Yukatek Maya children reason as much about biological categories in terms of essences as children in the United States, a finding that suggests that essentialism is a universal feature of the human mind (Atran, 2002). Moreover, young children often reason more in an essentialist fashion than adults, another indicator that this tendency is a stable part of human cognition (Gelman, 2004). Although humans are capable of exploiting the causal structure of the world in other ways than through essentialism, it provides a quick and efficient heuristic to do so—for example, if one apple is edible, one can quickly generalize that all are edible; if one tiger is dangerous, one can infer that all are dangerous. Interestingly, humans are not the only species to use essential reasoning in this adaptive way: rhesus monkeys (*Macaca mulatta*) also infer that superficial changes to the exterior of a fruit do not alter its inside properties (Phillips, et al., 2010).

Evans (E. M. Evans, 2000a, 2001) has found that young children until the age of ten have a preference for creationist accounts for the origin of species, and this is often accompanied with essentialist thinking. Creationists believe that God (or a “designer”) has created the biological world, which is divided into distinct, non-overlapping categories or kinds, the members of which share an unobserved essence that makes them belong to that particular category and which resists evolutionary change. For instance, in *Evolution? The fossils say NO!* (1978, p. 43), Young-Earth creationist Duane Gish firmly asserts that “the human kind always remains human, and the dog kind never ceases to be a dog kind. The transformations proposed by the theory of evolution never take place.” Intelligent Design adherents are no different in this regard. Although some claim that they have no issue with common descent, they too state that natural selection is limited to micro-evolution, which has always been conceded by creationists as limited change within “kind”. Towards naturalistic macro-evolution (“the molecule-to-man theory”, in the words of Gish), however, Intelligent Design proponents are as skeptical as any other creationist. As one of the leading figures within the Intelligent Design movement, the biochemist Michael Behe (1996, p. 15), puts it: “[T]he canyons separating everyday life forms have their counterparts in the canyons that separate biological systems on a microscopic scale. [...] Unbridgeable chasms occur even at the tiniest level.”

8.4.2 Teleology

Intuitively, humans not only view the world in terms of essences, but they also assume that things in the world happen or exist for a purpose. This teleological tendency

reveals itself from a young age. Four and five year olds are more inclined to ascribe functions to biological wholes and natural objects than adults do. They assume that lions are “to go in the zoo” and that clouds are “for raining” (Kelemen, 1999a). When asked “why rocks are so pointy,” seven to ten year olds prefer a teleological explanation (“so that animals wouldn’t sit on them and smash them”) over a purely physical explanation (“They were pointy because bits of stuff piled up on top of one another for a long time”) (Kelemen, 1999b). The teleological tendency wanes with age, which is probably due to the effects of science education. Scientifically untrained Romani adults were shown to be more prone to ascribe teleological explanations to non-biological natural entities than their educated peers (Casler & Kelemen, 2008). However, evidence suggests that education merely suppresses the teleological tendency, which continues to act as a mental default setting throughout the entire lifespan. Adults are more likely to endorse teleological explanations (“the sun makes light so that plants can photosynthesize”) when questioned under time pressure (Kelemen & Rosset, 2009). Also, Alzheimer patients tend to revert to teleological thinking as a result of their condition (Lombrozo, et al., 2007), indicating that the exposure to causal explanations only affects people’s reflective, but not their intuitive beliefs.

Understanding biological properties in teleo-functional terms, particularly in combination with our capacity to categorize, provides a rich and valuable source of information for making inferences about the environment. As such, the teleological stance can also be identified as a fast and frugal heuristic that may have added to our adaptive rationality. Some philosophers even argue that teleological reasoning forms an indispensable conceptual tool for acquiring a solid scientific understanding of the biological world (Ruse, 2003). Nonetheless, teleological intuitions have also been shown to highly constrain students’ understanding of evolutionary theory. Students tend to mistake natural selection for a goal-directed mechanism. Or, they assume that evolution as a whole moves towards an end, which is commonly identified with the human species (for a review, see Bardapurkar, 2008). Like essentialism, the teleological stance becomes an easy target for exploitation by irrational belief systems when it operates on unfamiliar terrain.

In creationist literature, the idea that things in this world exist because of a particular purpose is a strong and recurrent theme. In *Scientific Creationism*, under the subtitle *Purpose in creation*, Henry M. Morris (1974a, pp. 33-34) contends that “the creation model does include, quite explicitly, the concept of purpose”, and that “the creationist seeks to ascertain purposes.” Rhetorically, he asks his readers:

Do both fish and men have eyes because man evolved from fish or because both fish and man needed to see, in order to fulfil their intended creative purpose? Can stars and galaxies be arranged in a logical hierarchy of order from one type to another because they represent different stages in an age-long evolutionary

process, or because they were each specially created to serve distinct purposes, such purposes requiring different degrees of size and complexity?

The same notion of purposefulness also resonates throughout the entire Intelligent Design literature. In fact, the basic claim of the movement is that complex biological systems can be compared with artefacts, implying that they too have been made to serve a particular purpose. Often, people's teleological intuitions are brought in as a justification for the design inference. As William Dembski (1999, p. 48), another important Intelligent Design proponent, puts it:

Intelligent Design formalizes and makes precise something we do all the time. All of us are all the time engaged in a form of rational activity which, without being tendentious, can be described as 'inferring design.' Inferring design is a perfectly common and well-accepted human activity.

Naturally, being creationists, Morris and Dembski depict the alleged purposes in nature as resulting from the intentional actions of a supernatural agent. As such, creationism does not only hijack people's teleological intuitions, but also taps into the strong inclination of the human mind to detect other agents and understand their behaviour as motivated by intentions and desires. This makes creationism all the more cognitively appealing.

8.4.3 Detecting agents and the intentional stance

The human mind is highly prone to detecting agency and it often does so even in the absence of agents. Just think of the times you thought there was someone near when it turned out only to be some piece of garment hung out to dry on a clothes horse or a bush blown in the wind, or of the times you mistook a bag blown by the wind for a bird or a small animal. The opposite scenario, however, in which one mistakes an agent for an inanimate object, rarely occurs, even though it is in principle possible, e.g., mistaking a person for a mannequin, or a bird for a lump of earth and some leaves. At least two good evolutionary reasons have been proposed as to why the mind is more likely to produce false positives than false negatives when it comes to detecting agency. First, we can expect that agency detection is hyperactive, based on game-theoretical considerations involving predator-prey interactions, in particular the costs of false positives and negatives and the potential payoffs (Godfrey-Smith, 1991). For complex organisms that live in variable conditions and that rely on signals in the environment that are not always transparent, to make decisions, it is far less costly to assume that there is an agent when there is none than the other way around (Guthrie, 1993) — this is the case not only for animals that need to avoid predators, but also for predators looking for

potential prey, in which case the potential benefit outstrips the costs of a false positive. Because of the asymmetry between costs, natural selection favors organisms with an agency detection device that occasionally generates false positives rather than false negatives. Second, agency detection is not only related to predator-prey interactions, but is also highly relevant for the detection of the attention of conspecifics. Being watched may have consequences for one's reputation. Any reputational damage might entail a decrease in cooperation opportunities, thus limiting access to vital resources which, in turn, affects reproductive success. This provides a plausible scenario for why the human mind is hypersensitive to cues of being watched by other agents. For example, a picture of two eyes suffices to induce people to put more money in a donation box (Bateson, et al., 2006), or leave significantly less litter in a canteen (Ernest-Jones, et al., 2011); stylized eyespots on a computer screen or an eye-like painting significantly increase generosity in a Dictator Game (Haley & Fessler, 2005; Oda, et al., 2011).

Evolutionary psychologists argue that the human mind has an evolved capacity to interpret the behavior of other agents as motivated by internal states, such as intentions and beliefs. Adopting the “intentional stance” (Dennett, 1987) allows one to predict the behavior of complex organisms. To account for the origin of this capacity, two scenarios have been proposed—they are related to the scenarios set out above explaining human hypersensitivity to the presence of other agents. One is that the intentional stance has evolved in order to deal with complex social interactions. This Machiavellian intelligence hypothesis traces the evolution of human mind reading in the complex social interactions that most primates entertain. Given the large group sizes in humans compared to other primates, humans require more sophisticated mindreading skills to successfully interact with group members (see e.g. Byrne, 1996; Humphrey, 1976). The other suggests that this stance has evolved in relation to predator-prey interactions: the ability to remain undetected by predators, or to find prey requires that one is able to accurately predict what other agents will do (H.Clark Barrett, 2005; Boyer & Barrett, 2005). For the purpose of this chapter, we need not decide between these hypotheses, which are also not mutually exclusive. The human mind does not only have the capacity to interpret the behavior of agents in term of their intentions, it also forms expectations as to what agents are capable of, in particular in relation to inanimate objects. Ten-month-old babies assume that only agents create order out of chaos (Newman, et al., 2010), and 10- to 12-month-olds expect an object's movement only to be caused by a human hand, not by an inanimate object (Saxe, et al., 2005). These inferences add to the rich explanatory power that comes with human intuitive psychology, or theory of mind.

This intuitive psychology is easily triggered. Adults have been shown to overattribute intentions to purely natural events. Sentences like “she broke the vase” are by default interpreted as describing an intentional act, not something that happened by accident

(Rosset, 2008). However, it is unclear whether folk psychological intuitions are also invoked by and connected with the teleological intuitions discussed above. In the case of artefacts, there is an obvious link between the purpose of the artefact and the intention for making it, which results in the “design stance” (Dennett, 1987). For instance, both children and adults privilege creator’s intent over later afforded usage when deciding which function to attribute to an artefact (Chaigneau, et al., 2008; Kelemen, 1999a). But concerning the natural world, the connection between the teleological and intentional stance is far less apparent. Both Evans (2000b) and Kelemen and Di Yanni (2005) have established a link between these two stances in 7- to 10-year-old children from the USA and the UK respectively, independently of their being raised in a religious cultural environment. Based on these findings Kelemen (2004) coined the term “intuitive theists,” meaning that these children intuitively project an agent who is responsible for creating the world. However, the Dutch children that were probed by Samarapungavan and Wiers (1997) for their beliefs concerning the origins of species did not express such a creationist inclination. Furthermore, in the aforementioned studies with Alzheimer patients (Lombrozo, et al., 2007) and adults under time pressure (Kelemen & Rosset, 2009), the teleological and intentional stance were not clearly correlated. Alzheimer patients, despite their increased endorsement of teleological explanations, were not more likely to invoke God as an explanation compared to healthy control subjects. People who were more likely to endorse teleological explanations under time pressure were not more likely to believe in God. In sum, intuitive teleology cannot be equated with intuitive theism (De Cruz & De Smedt, 2010). It seems that people’s creationist intuitions are not as deeply ingrained as their teleological intuitions.

Even though theism is not intuitive in the sense of being an innate, untutored intuition, it nevertheless is easy to grasp and natural for minds like ours, that are hypersensitive to the actions of agents, that readily infer intentionality, and that consider only agents to be capable of creating movement and order. The suggestion that the world is the result of a creative act by a hidden supernatural agent is something that makes intuitive sense. Indeed, creationists insist that the intentions of such an agent can be read off from both the order and the beauty in the universe and the functional complex systems found in nature. For instance, Morris (1974a, p. 33) writes:

The Creator was purposive, not capricious or indifferent, as He planned and then created the universe, with its particles and molecules, its laws and principles, its stars and galaxies, its plants and animals, and finally its human inhabitants.

And, also:

The creationist explanation will be in terms of primeval planning by a personal Creator and His implementation of that plan by special creation of all the basic

entities of the cosmos, each with such structures and such behavior as to accomplish most effectively the purpose for which it was created.

Hence, creationists compare the bacterial flagellum with an outboard rotary motor (Behe, 1996), and conceptualize DNA as some kind of code, programmed by an intelligent designer (Davis, et al., 1993; Morris, 1974b). In biology school books, artefact metaphors are commonly used as explanatory tools to make sense of complex biological systems which points to their strong intuitive appeal. However, because of this appeal, they can become an alluring piece of rhetorical equipment in the hands of creationists, who intend these metaphors to be taken quite literally (Pigliucci & Boudry, 2011).

8.5 Discussion

Although we have limited our discussion of mental predispositions exploited by creationism to the essentialist, the teleological and the intentional biases, there may be other biases at play as well. For instance, the intuitions that humans are fundamentally different from other animals (De Cruz & De Smedt, 2007), and that mind and body belong to two separate ontological domains (Bloom, 2004; Slingerland & Chudek, 2011) are other good candidates to explain widespread pseudoscientific thinking. Also, we have only demonstrated how creationism piggybacks on those inference systems, but we hold that the same reasoning goes for other pseudosciences as well. Essentialism, for instance, may contribute to explaining the persistence of homeopathy (Hood, 2008)—even if a substance is diluted to the point that it is no longer chemically detectable, our intuitive essentialism can lead to the mistaken intuition that the essence of the product is still there. Note, however, that we do not intend to debunk the beliefs that make up pseudosciences simply by demonstrating that pseudosciences tap into people's evolved intuitions. Doing so in a straightforward way would be committing the genetic fallacy. One could make a debunking argument by claiming that our evolved inference systems are systematically off-track or unreliable, but this does not seem to be the case. After all, these cognitive predispositions at least produce ecologically rational solutions to recurrent problems the human mind has evolved to solve. Furthermore, scientific beliefs too rely on intuitive assumptions. For example, scientists share with young children (e.g. Saxe, et al., 2005) the intuition that any contingent state of affairs has one or more causes to account for it. The search for (often non-obvious) causes is part of our intuitive understanding of the world that is continuous between scientific and everyday reasoning (De Cruz & De Smedt, in press). Hence, if dependence on evolved biases would

count as a debunking argument, scientific beliefs would also be susceptible to debunking arguments, a conclusion we obviously do not want to draw. Rather, a cognitive and evolutionary approach to pseudosciences helps to explain why people steadfastly adhere to such belief systems, even in the face of strong defeating evidence.

8.6 Context biases, or why pseudoscience?

Irrational (reflective) belief systems tend to mimic real sciences, sometimes down to the smallest detail. Biblical creationism has developed into scientific creationism or Intelligent Design, osteopathy and the like are presented as alternative treatments that are on a par with modern medicine, and contemporary vitalistic theories use scientific terms like “energy” to leave a scientific impression. Obviously, these pseudosciences piggyback on the authority science has been endowed with in modern society. However, the question remains as to why it is so important for pseudosciences to seek that authority and, also, why they often succeed in attaining it. Again, an evolutionary and cognitive perspective can shed some light on these issues.

Humans are social rather than individual learners: they gain significantly more information through communication with conspecifics than by direct experience with the environment. Although the benefits of social learning, the extent of which is unique to humans, are huge (one has access to much more information at a much lower cost), such a capacity would not have evolved if humans did not have ways to protect themselves from being misinformed. Therefore, Mercier and Sperber (2011) have argued that humans are critical social learners, who exhibit epistemic vigilance with regard to socially transmitted information: they critically evaluate both the content and the source of the information received. As to the latter, both cues that signal competence and benevolence are important, but these are less easy to trace when one is confronted with information that is transmitted via cultural communication. As a result, the epistemic vigilance warranted by the heuristics that track such cues might break down (Sperber, et al., 2010). To deal with the resulting uncertainty and to restore protection against false beliefs, a predisposition might have evolved to trust epistemic authorities, that is individuals (or, by extension, institutions) other people defer to as being competent and benevolent sources of information (Henrich & Gil-White, 2001). Hence, people may put their epistemic trust in authorities, simply for the reason that the latter are commonly acknowledged as such. Why has science come to enjoy this epistemic authority? Undoubtedly, the tremendous instrumental efficacy of science, in the form

of, for instance, efficient medicine and communication technology, has been an important factor in its widespread public acceptance. However, it is important to point out that this trust is not universal and that in some communities people defer to religious authorities as a source of reliable information (Kitcher, 2008). Religion is historically and socially well-embedded in these communities, where it has public support and is also endorsed in education (denominational education, Sunday school). If people indeed place their epistemic trust in science, why is this trust not universal, and why are some pseudosciences like creationism widely endorsed? One reason is that creationists successfully present themselves as scientifically legitimate. Many of their proponents have a PhD, and publish books and papers in scientific fields. Given that their claims enjoy the extra advantage of being in line with our evolved cognitive predispositions, such as essentialism, teleology and the intentional stance—whereas real science often runs counter to these intuitions—they can successfully win converts among the general public.

8.7 Conclusions

Let us return to the question in the title. Are we evolved to be irrational? Given the ubiquity of pseudosciences, this seems a fair question to ask. However, from an evolutionary perspective, we should at least expect some rationality. The representations an evolved mind generates should at least allow an organism to respond aptly, and thus rationally, to environmental situations. The human mind is stacked with fast and frugal heuristics, the operations of which result in an adaptive, ecological rationality. But, when these heuristics operate outside their proper domain in solving abstract and complex cognitive problems that require a reflective mode of thinking, their output becomes subjugated to the normative rationality of logic and probability theory. Hence, when their impact on reflective thinking remains unchecked, we are likely to endorse irrational beliefs. The probability of endorsing pseudosciences increases when they are given an air of scientific respectability, which allows them to coast on the epistemic authority that scientific theories enjoy. Therefore, although we could not have evolved to be irrational, sometimes people are irrational because we have evolved.

Part 3 – Educational perspectives

Chapter 9

The implications of the cognitive sciences for the relation between religion and science education: the case of evolutionary theory¹

Abstract

This paper discusses the relationship between religion and science education in the light of the cognitive sciences. We challenge the popular view that science and religion are compatible, a view that suggests that learning and understanding evolutionary theory has no effect on students' religious beliefs and vice versa. We develop a cognitive perspective on how students manage to reconcile evolutionary theory with their religious beliefs. We underwrite the claim developed by cognitive scientists and anthropologists that religion is natural because it taps into people's intuitive understanding of the natural world which is constrained by essentialist, teleological and intentional biases. After contrasting the naturalness of religion with the unnaturalness of science, we discuss the difficulties cognitive and developmental scientists have identified in learning and accepting evolutionary theory. We indicate how religious beliefs impede students' understanding and acceptance of evolutionary theory. We explore a number of options available to students for reconciling an informed understanding of evolutionary theory with their religious beliefs. To conclude, we discuss the implications of our account for science and biology teachers.

¹ This paper has been accepted for publication in *Science & Education* (Blancke, De Smedt, et al., in press). Parts of this paper have been presented at the annual meeting of the Society for the Scientific Study of Religion, 29-31 October 2010, Baltimore, Maryland.

9.1 Introduction

Evolutionary theory is notoriously difficult to properly understand. It involves emergent processes and complex systems (Chi, 2005; Jacobson & Wilensky, 2006); it introduces abstract prerequisite notions, such as population and undirected variation, and it depends both on blind forces and on a vast time frame (Dawkins, 1986). Furthermore, the acceptance of evolutionary theory is hampered by emotional obstacles, such as an attachment to the existence of a caring and omnipotent creator, and to an immortal soul (Thagard & Findlay, 2010). Also, learning and understanding evolutionary theory requires much more than merely absorbing new information. Previous work has highlighted specific cognitive obstacles to understanding evolutionary theory, such as essentialist thinking about species, the human penchant for teleological reasoning, and our ability for agency detection.

Students are more inclined to reject evolutionary theory when they are presented with alternatives deeply anchored in their intuitive theories, such as creationism and intelligent design. The global rise of creationist activity has therefore severe consequences for the position of evolutionary theory in science education (Blancke, Boudry, et al., in press). In this paper, we widen the scope of this discussion by exploring the implications of human biases not only for creationism, but for religion in general. In particular, we focus on the relation between evolutionary theory and religious views on the origin of life's diversity and complexity and the origin of humans.² As we will see, religion in general, and not just creationist religion, appeals to precisely the cognitive intuitions that hinder an understanding of evolution.³

We begin by briefly challenging the popular view that science and religion are compatible, a view that suggests that learning and understanding evolutionary theory has no effect on students' religious beliefs and vice versa. We then proceed to develop a cognitive perspective on how students manage to reconcile evolutionary theory with their religious beliefs. Relying on the distinction and interaction between intuitive and

² Because we will deal here with universal aspects of the human mind, we do not have a particular religion in mind. Nevertheless, the following discussion will be particularly relevant for, and is therefore primarily intended at, learning and understanding evolutionary theory in relation to Christian beliefs.

³ The distinction between creationist and other Christian belief systems might appear somewhat artificial in the sense that any form of Christianity introduces the belief that God somehow *created* this world. We will use the word creationism here to indicate the belief that God has actively and directly intervened in this world, whether in the construction of the universe, in the creation of species or the design of biological functional complexity (adaptations). Such creationist beliefs often come with a resentment against evolution. Non-creationist religious beliefs hold that God created through secondary laws, that is, indirectly and thus tend to be more science-friendly.

reflective beliefs, we underwrite the claim developed by cognitive scientists and anthropologists that religion is natural because it taps into people's intuitive understanding of the natural world, which is constrained by essentialist, teleological and intentional biases. After having briefly contrasted the naturalness of religion with the unnaturalness of science, we then discuss the difficulties cognitive and developmental scientists have identified with learning and accepting evolutionary theory in relation to the biases mentioned above. Next, we indicate how religious beliefs impede students' understanding and acceptance of evolutionary theory. We then discuss a number of options available to students for reconciling an informed understanding of evolutionary theory with their religious beliefs. To conclude, we discuss the implications of our account for science and biology teachers.

9.2 Religion and biological education: are they compatible?

Moderate and liberal religious leaders typically claim that evolutionary theory is compatible with their faith and make no attempt at opposing science education (see, for instance, the list of religious organizations in Sager, 2008). The rationale behind this compatibilism is that science and religion cover separate domains of knowledge, a position defended by religious and non-religious authors alike. Famously, palaeontologist Stephen Jay Gould (1997) proposed that science and religion constitute non-overlapping magisteria (NOMA). Whereas science is interested in the natural world and how it operates, religion deals with the meaning of life and with moral issues. The most common compatibilist position today states that science is by definition committed to searching natural explanations for natural phenomena. For instance, Philosopher Robert Pennock (1999, p. 284) claims that "science does not have a special rule just to keep out divine interventions, but rather a rule that it does not handle any supernatural agents or powers since these are taken by definition to be above natural laws". The supernatural⁴ is absent from science, but that is not to say that the supernatural does not exist. Science simply lacks the methods to say anything meaningful about the supernatural, which is the exclusive proper domain of religion. As

⁴ Here, we will apply the term 'supernatural' as some of the authors have defined it elsewhere (Boudry, et al., 2010a), namely as "referring to any phenomenon which has its basis in entities and processes that transcend the spatiotemporal realm of impersonal matter and energy described by modern science."

science is neutral with regard to different worldviews, one can practice science while still being a devout Christian or Muslim.

This view on science and religion, which has been termed methodological naturalism, is propounded by the (American) National Academy of Sciences and the National Center for Science Education, as well as by philosophers of science (e.g., Pennock, 1999), religious and non-religious scientists (e.g., K. R. Miller, 1999; Scott, 2004), theologians (e.g. Haught, 2000), and religious leaders (Sager, 2008). Educational scientists too (but see Chinn & Buckland, 2011 for a differing opinion; e.g., Nelson, et al., 1998; Sinatra & Nadelson, 2011) support this view, stressing the importance of a correct understanding of science in science education; this position offers the additional advantage of reassuring students that evolutionary theory does not pose a threat to their religious convictions.

However, the identification of science with naturalistic explanations, and religion with supernatural explanations is less clear-cut than is often assumed. Historically, the view that science has no authority over supernatural causes was not the default position in scientific practice: in *On the origin of species*, for instance, Darwin (1859) repeatedly compared the explanatory merits of his theory of evolution by natural selection with what he referred to as the *theory* of special creation. Rather than discarding special creation for its appeal to supernatural causes, Darwin took the program of natural theology quite seriously as a rival explanatory model. For instance, he writes:

[N]ature is prodigal in variety, but niggard in innovation. Why, on the theory of Creation, should this be so? Why should all the parts and organs of many independent beings, each supposed to have been separately created for its proper place in nature, be so invariably linked together by graduated steps? Why should not Nature have taken a leap from structure to structure? On the theory of natural selection, we can clearly understand why she should not; for natural selection, we can clearly understand why she should not; for natural selection can act only by taking advantage of slight successive variations; she can never take a leap, but must advance by the shortest and slowest steps. (Darwin, 1859, p. 194)

In doing so, Darwin was not being unscientific; he was merely demonstrating that his new model – which happened to be naturalistic – was superior to the old one relying on supernatural origins. The outlook of modern science is naturalistic indeed, as Boudry and colleagues (2010a) have argued, but this should not be construed as a definitional matter or self-imposed limitation on science. Rather, the naturalistic outlook is a contingent result of scientific progress over the centuries. Supernatural causes are amenable to scientific investigation, but our current understanding of the world simply shows no need for such explanations.

At an educational level, the compatibilist position suggests that learning evolutionary theory has no bearing on students' religious beliefs, and that, conversely,

religion has no negative effect on students' learning of evolutionary theory. However, if the separation between science and religion is philosophically shaky, and both compete in the same explanatory realm, we are invited to take a closer look at the relation between religion and the learning of evolutionary theory from a cognitive perspective. Mahner and Bunge (1996) have argued that religion and science are incompatible because they are different at a doctrinal, metaphysical, methodological and attitudinal level and that this incompatibility extends towards religious and science education. Our cognitive account expands on their analysis, although we draw somewhat different conclusions.

9.3 The naturalness of religion

Central to our cognitive approach is the distinction and interaction between reflective and intuitive beliefs. Reflective beliefs are the kind of beliefs we are all familiar with, because we entertain them on a conscious level and use them in our explicit reasoning. Intuitive beliefs, by contrast, are automatically generated by the brain when presented with appropriate cues. The latter beliefs, though people are not aware that they have them, affect or constrain reflective beliefs in important ways. Sometimes they act as a default for reflective beliefs, in other cases they determine which reflective ideas seem more plausible (J. L. Barrett & Lanman, 2008). The more reflective beliefs are in tune with intuitive beliefs, the more sense they make, or, in other words, the more natural they feel. As a result, such beliefs are easily represented, remembered and transmitted and become more widely dispersed.

This distinction between intuitive and reflective beliefs forms an essential component to our understanding of cultural evolutionary processes in general (Sperber, 1996). Reflective beliefs that are anchored into intuitive beliefs have a better chance of becoming stable cultural representations. Because religious beliefs has been found to be prevalent among all cultures, cognitive scientists and anthropologists have come to apply this framework to the study of religion as well (Boyer, 2001). Researchers in the cognitive science of religion claim that religion is natural (McCauley, 2000) because it taps extensively into people's intuitive and non-reflective modes of reasoning, including essentialist, teleological and intentional intuitions.

9.3.1 Essentialism

Anthropological and historical research shows that humans naturally and spontaneously think along essentialist lines (Atran, 1994; Mayr, 1991). People mentally carve up nature into categories, the members of which share a similar inner essence. This essence or core defines their being, accounts for their properties and behaviour, and guides their development (Gelman, 2004; Medin & Ortony, 1989). The probable evolutionary function of psychological essentialism is that it allows for a wide range of inductive inferences (H. Clark Barrett, 2001): for instance, people are able to predict the ontogenetic development of organisms, e.g., flowers turn into fruits and eggs into birds – both fruits and birds are good for eating. Three-year-olds readily infer that inherited traits trump external circumstances: they correctly predict that an apple-seed, planted in a flower-pot, will grow into an apple tree and not into a flower (Gelman & Wellman, 1991). Children also resist the idea that organisms can change category membership through superficial alterations (Keil, 1989). Five-year-olds know that painting a raccoon to make it look like a skunk does not change it into a skunk. Nor would a surgical operation: an animal altered through surgery to resemble a member of another species is still a member of the original species. Four-year-olds think that a young goat, raised by kangaroo foster parents, will not hop but rather climb like goats do, even though it may never meet another goat in its life (Gelman & Wellman, 1991). It is important to note that children's knowledge of essences does not result from enculturation by their parents. Indeed, children are stauncher essentialists than adults of the same culture. For example, Indian children (but not adults) believe that a Brahmin child will remain Brahmin, even when raised by untouchables; five-year-old British children believe that French babies brought up by English-speaking parents will grow up to speak French (for an overview, see Gelman, 2004; Gelman, et al., 1994).

9.3.2 Teleology

People intuitively assume that animals and plants have parts serving purposes that are beneficial for their owners, such as claws in cats for climbing or defence, or thorns in plants to prevent them from being eaten. This style of reasoning has been termed 'teleology' – it is an explanatory strategy that invites us to see the purpose or goal of a given structure as a necessary and sufficient explanation for its existence. Teleology allows children to learn useful facts about organisms. Even three-year-olds can infer the diet of an unfamiliar animal based on the shape of its beak, or predict that an unfamiliar mammal with webbed feet lives in the water (Kelemen, et al., 2003). In western

philosophy, teleology has become an explicit assumption at least since Aristotle, but preliminary cross-cultural studies indicate that it is also found in other cultures, such as the Shuar, Native Americans from the Andes. Like westerners, the Shuar classify animals and plants according to their functional parts, and think about these parts in terms of goal-directedness (H.Clark Barrett, 2004). Children often provide or endorse teleological explanations even when these are inappropriate, a tendency that Kelemen (1999a, 1999b) termed 'promiscuous teleology'. Five-year-olds believe that lions exist 'to go in the zoo', and that clouds hang above us 'for raining' (Kelemen, 1999a, 1999b; Kelemen, et al., 2003). Until the age of about 10 children prefer teleological accounts to non-teleological mechanistic accounts. When asked whether rocks exist because 'bits of stuff piled up for a long period of time' or 'so that animals could scratch on them when they got itchy', children typically prefer the latter account – rocks are there for a reason (Kelemen, 2003). Again, this knowledge does not simply derive from their parents, who actually prefer natural over teleological explanations in conversations with their children (Kelemen, et al., 2005).

During adolescence, the preference for teleological explanations wanes: although we know that mountains can be climbed, we are not inclined to say that they exist for climbing in the first place. This is probably due to the acquisition of mechanistic, non-teleological explanations during education. In the case of mountains, we have learned about formation by plate-tectonic or volcanic activity. Similarly, when schooled, children by the age of ten no longer ascribe purposes to non-living natural objects, and they explain biological properties mainly in terms of self-serving rather than social or other-serving functions (Kelemen, 1999b; Kelemen & Di Yanni, 2005). In uneducated adults, however, the teleological tendency remains unscathed (Casler & Kelemen, 2008). Moreover, even in the minds of educated adults teleological explanations are not completely eradicated. In one experiment, elderly people were given a choice between teleological and non-teleological explanations. In contrast to healthy seniors, Alzheimer's patients showed a re-emerging preference for teleological accounts (Lombrozo, et al., 2007). For instance, they thought that it rains so that plants and animals have water to drink and grow, rather than choosing the acquired mechanical explanation that rain occurs by water vapour condensing into clouds and forming droplets. Similarly, in speeded judgment tasks, where schooled adults have to choose very quickly between teleological and non-teleological explanations, they too show an increased tendency to reason teleologically (Kelemen & Rosset, 2009). It appears that the teleological tendency acts as a mental default setting for understanding the natural world, and that as such, it never really disappears.

9.3.3 Agency detection, intentionality and the design stance

The human mind is prone to detecting agents, even when only presented with the most basic cues. For instance, when confronted with contingent movements of dots on a computer screen or a suspicious sound, our mind automatically infers the presence of agents (Guthrie, 1993). This tendency to over-detect agency makes good evolutionary sense. In ancestral environments, where predators and other humans formed a constant threat, detecting agents was often a matter of life and death. In such a situation, it is better to be safe than sorry. Mistaking the wind rustling through the leaves for an agent is far less costly than making the opposite mistake. Moreover, because we are social animals, being watched by human or human-like agents may have serious effects on one's reputation, whether beneficial or detrimental. Humans have been shown to behave more altruistically in response to minimal cues of being watched, like pictures of eyes inducing people to be more generous when having to leave money in a donation box in a canteen (Bateson, et al., 2006). The crucial role of agents in human survival and sociality provides a plausible explanation of our ability to discriminate between (human) agents and inanimate objects and to reason differently about what causes their motion (Spelke, et al., 1995). We also hold different expectations as to what specific actions the members of each category are capable of. For instance, 12-month-old infants expect the ultimate cause of a moving inanimate object to be an agent (Saxe, et al., 2005). They also assume that agents, but not inanimate objects, are capable of creating order out of disorder (Newman, et al., 2010). Most importantly, they interpret human agents' goal-directed behaviour in terms of intentions (Gergely, et al., 1995). By the age of five, this intentional stance expresses itself in our reasoning about artefacts. Children spontaneously understand artefacts as having been construed with a particular purpose or function in mind; one study suggests that even 3-year-olds categorize artefacts not on the basis of their shape, but according to their intended function (Diesendruck, et al., 2003). Dennett (1987, pp. 16-17) referred to this function-based attitude towards artefacts as "the design stance".

Humans adopt both the intentional and the design stance in accounting for the natural world as well. Creation stories worldwide explain the existence of the world in terms of intentional acts of superhuman agents (Leeming & Leeming, 1995) and, in both religious and scientific contexts, complex functional features of organisms are commonly compared to human artefacts (De Cruz & De Smedt, 2010; Recker, 2010). Evans (2001) noted a preference for creationism in elementary school children, and Kelemen and DiYanni (2005) found a significant connection between children's teleological reasoning and their creationist assumptions. In their study with Alzheimer's patients, however, Lombrozo and colleagues (2007) found a dissociation between these two factors. Likewise, Samarapungavan and Wiers (1997) found a variety of responses when probing Dutch children's reasoning about origins: only 10 % of these subjects

endorsed explicitly creationist ideas. These findings suggest that belief in creationism probably does not result directly from ready-made creationist intuitions. However, because creationism taps into our intuitive expectations concerning intentional agents, people will readily endorse them when they are culturally available (E. M. Evans, 2000a; Petrovich, 1997). The prevalence of creationist stories about (the origin of) the natural world throughout human history and around the globe demonstrates their enduring intuitive appeal.

Studies probing into young children's concepts of God show that their understanding of God's mind is firmly anchored in intuitive psychology (Lane, et al., 2010; Makris & Pnevmatikos, 2007; Shtulman, 2008). Conversely, available religious beliefs and representations involving anthropomorphised supernatural agents have a strong intuitive appeal. Moreover, these religious beliefs confirm the intuitive expectations people have. As such, it can be expected that the more intensely religious beliefs are adhered to, the stronger these beliefs will bolster or enforce those intuitions. Diesendruck and Haber (2009), for instance, have found that children of orthodox Jews resort more to essentialist and teleological thinking than children of secular Jews. These findings indeed suggest that there is a connection between religiosity and the effect of cognitive biases on individuals' representations of the natural world.

9.4 The unnaturalness of science

The intuitive appeal and naturalness of religion stands in sharp contrast to the unnaturalness of science (McCauley, 2000). Scientific beliefs contradict many intuitive expectations about the world. These need to be overcome in order to understand science, a process that requires years of intense training. This holds for general relativity, electromagnetism, plate tectonics, and other highly counterintuitive theories, and even for concepts such as physical inertia or the spherical shape of our planet (Vosniadou, et al., 2008). In the same vein, evolutionary theory is not readily assimilated by a mind that is intuitively inclined to discern essences, purposes and intentions in the natural world. The theory holds that species do not reflect immutable essences, but rather represent populations of individual organisms whose characteristics are distributed around a mean average changing with every new generation. The apparent purposes that can be discerned in nature are merely the result of a slow, gradual process by which organisms become adapted to their environment. Evolutionary innovation is not intentional, but rather arises from the retention of undirected variations.

Essentialist, teleological and intentional intuitions have nurtured recurrent and predominant themes in Western thought about the natural world. Essentialism was a central element in Platonic and Aristotelian thinking, which dominated biological thought until well into the 19th century (De Cruz & De Smedt, in press). Darwin himself witnessed the effects of our cognitive biases when his contemporaries tended to misconstrue evolution by natural selection as a directed and intentional process. The question of whether talk of teleology is legitimate in biology (i.e., whether the functions of traits like the eye can be explained in terms of purposes) continues to be a bone of contention in philosophy of biology, with prominent thinkers on both sides of the debate. For example, Ayala (1970) and Ruse (2003) argue in favour of teleology as a result of blind design: although selective processes are not goal-directed, the structures arising from them are. Papineau (2005), on the other hand, contends that teleology should be excised from biological discourse: the function of a trait is not a result of its purpose, but a consequence of the fitness advantages it bestowed on ancestral organisms. We realize that these debates are more substantive but we do not intend to engage with this discussion here. Yet, discussions like these underscore that, more than 150 years after Darwin laid the theoretical foundations for our modern understanding of the biological world, it remains unclear whether or not teleological reasoning constitutes a crucial component of our understanding of evolution.

9.5 (Mis)understanding evolutionary theory

A series of studies on the understanding of evolutionary theory confirms this picture of science's unnaturalness. Shtulman and Shultz (2008) found that people who think along essentialist lines are more likely to misunderstand evolutionary theory. The study by Samarapungavan and Wiers (1997) mentioned above, which probed beliefs on the origin of species until late childhood, found that children entertain various models, including essentialism, creationism and even Lamarckism, but not a single child was able to restate the principles of evolutionary theory. The closest were the so-called 'dinosaur-essentialists', who believe that each species alive today has a dinosaur-ancestor: cats descended from dinosaur-cats, giraffes from dinosaur-giraffes, etc. Evans (2000b) too found that children who prefer evolutionary explanations believed evolution to be working in a Lamarckian fashion, by which changes occur directly to meet the needs of organisms. Even in high school, students keep encountering difficulties with the concept of natural selection, often thinking that organisms 'have to' develop a given

trait in order to survive. In these accounts (see e.g., Bardapurkar, 2008 for a collection), adolescents regard the function of a trait as a sufficient causal explanation of its existence, which accords with teleological reasoning but not with evolutionary theory. A sixteen-year-old girl claimed that arctic foxes developed a thick fur because they were so cold. A high school student thought that ducks needed to evolve webbed feet in order to move around more swiftly in the water. Adolescents also assume that organisms can pass on acquired traits to the next generation. Even youngsters with some knowledge of genetics keep falling back on Lamarckian explanations: for example, they believe that children of two white parents living in Africa will be born with a darker skin, because their chromosomes would already have adapted to the tropical climate.

A cause for concern is that not only children and students but biology teachers too are susceptible to misunderstanding evolutionary theory (Rutledge & Mitchell, 2002). In a review article of surveys on misconceptions about natural selection, Gregory (2009, p. 163) concludes:

Three decades of research have produced unambiguous data revealing a strikingly high prevalence of misconceptions about natural selection among members of the public and in students at all levels, from elementary school pupils to university science majors. [...] It is particularly disconcerting and undoubtedly exacerbating that confusions about natural selection are common even among those responsible for teaching it.

And he notes that “[m]ost of these [misconceptions] derive from deeply held conceptual biases that may have been present since childhood” (Gregory, 2009, p. 172). These biases are so persistent that even scientists cannot always resist their influence (De Cruz & De Smedt, 2007).

Learning evolutionary theory does not simply entail adding new information to the stock of knowledge, but requires thorough conceptual change. Students need to lift the concepts by which they reason about a particular domain of the natural world out of their intuitive – that is, essentialist, teleological and intentional – frameworks and bring these concepts to use in a scientifically informed understanding of that domain (Carey & Spelke, 1994; Vosniadou, et al., 2008). Such conceptual change involves not simply enriching but actually restructuring students’ knowledge, a goal that can only be achieved by employing educational tools and strategies specifically designed for that purpose.

One crucial step towards a correct understanding of evolutionary theory is to make students aware of their own misconceptions (González Galli & Meinardi, 2011; Vosniadou & Ioannides, 1998). By letting students explain biological phenomena in their own terms, their implicit beliefs are brought to the fore, allowing teachers to identify any errors and misconceptions. Teachers can also confront students with biased representations of evolutionary theory in computer games (Bean, et al., 2010) or science

fiction stories (González Galli & Meinardi, 2011), in order to assist them in examining their own conceptions. Students will be more prone to change their minds when teachers present them with concrete experiences and real-life examples (Sinatra, et al., 2008; Vosniadou & Ioannides, 1998). Applying evolutionary theory to cases with which students are already familiar, such as genetically modified food (Sinatra, et al., 2008), or cases that intrigue them, like forensics (E. M. Evans, 2008), will motivate them to find the study of the theory more appealing.

Teachers should also be careful about what language they use when talking about evolution. Adaptations, for instance, are often explained in teleological or intentional terms. When we are confronted with a complex and functional biological feature, the question arises what it is for, suggesting that it has evolved with the goal of performing a particular function. Animals are said to adapt to their environment as if they need or want to do so. When rightly interpreted, such language need not be problematic. Evolutionary scientists often speak in such terms as shorthand for more complex processes and phenomena. Indeed, need-based reasoning might provide the necessary scaffolding for students to learn to appreciate the concept of selective pressure, which forms an essential step towards the comprehension of natural selection (E. M. Evans & Lane, 2011). However, when teachers neglect to point out the metaphorical nature of teleological language, they might not override but actually entrench students' biased understanding of the theory⁵.

9.6 Religion and the understanding and acceptance of evolutionary theory

Learning and accepting evolutionary theory becomes even more difficult when students are supplied with models that tap into and hence enforce their incorrect intuitions. Creationism is only one of these models. In this paper, we argue that more liberal religious positions tend to have the same effect. Although they are claimed to be compatible with evolution, the way they envisage evolutionary processes often appeals to people's intuitive understanding as well. For instance, in 1996 the late Pope John Paul II declared that evolutionary theory is "more than a hypothesis", indicating that said

⁵ (E. M. Evans, 2008; E. M. Evans, et al., 2011; González Galli & Meinardi, 2011; Sinatra, et al., 2008)

theory could be reconciled with Roman Catholic faith. In the same text, however, he distinguished between several theories of evolution (materialist, reductionist and spiritualist) and noted “with man, then, we find ourselves in the presence of an ontological difference, an ontological leap, one could say” (John Paul II, 1996). These qualifications illustrate that he did not accept the entire scientific corpus of evolutionary theory, especially not the evolutionary study of the human mind. The pope believed that the human “spiritual soul”, unlike the human body, had been “immediately created by God” at some point during hominid evolution. This ontological leap endowed humans with divine essences while their bodies were prepared by evolution. We form the ultimate goal of a purposeful evolutionary process intended by God. In other words, although John Paul II paid lip service to evolutionary theory, he actually endorsed a version of evolution that was infused with religious beliefs tied to Catholic dogma. The Pope represented evolution as a teleological and intentional process which prepares bodies for receiving particular essences such as the human soul. Moreover, the representation is also constrained by an intuitive human/non-human distinction (De Cruz & De Smedt, 2007) and an intuitive dualism that regards mind and body as part of separate ontological realms (Bloom, 2004). Both ideas are unsupported by modern biology and neurology.

We do not intend to say that Pope John Paul II did not understand evolutionary theory, but rather that his religious convictions prevented him from accepting evolution by purely natural processes, and, concomitantly, led him to embrace a version of evolution anchored in essentialist, teleological and intentional intuitions. When young people are raised in a cultural environment in which religious authorities endorse such views on evolution, one might expect that their understanding of evolutionary theory would be adversely affected. Even when students are able to attain a full-fledged understanding of the theory, such views retain not only their intuitive but also their emotional and social appeal. As such, they might still prevent students from accepting evolutionary theory.

For religious students who have learnt and come to accept evolutionary theory, such an amalgam of religious and scientific views on the natural world might not suffice and lead to cognitive dissonance. The model outlined by the previous Pope raises several difficult questions. Why would a perfectly natural evolutionary process suddenly be interrupted by divine intervention? Did God simply wait for a suitable hominid lineage to emerge, or did he steer evolution in a particular direction? But then what to make of the undirected character of evolution according to modern science? And how did God manage to infuse biological organisms with immaterial souls? If students want to maintain their religious faith, they need better ways of reconciling it with evolutionary theory. To be sure, recent theological accounts (e.g., Haught, 2000) have attempted to respect scientific findings and to reconcile a theistic worldview with the randomness, lack of direction, and animal and human suffering that results from evolution. The

question whether such theistic evolutionary accounts are philosophically successful has elicited considerable debate in philosophy and theology that goes beyond the scope of this paper. In the next sections, we will examine whether such a reconciliation is possible at a *cognitive* level.

Preston and Epley (2009) found that people experience what they call “an automatic opposition” between explanations in terms of God and scientific explanations. A poor scientific explanation for the origin of life and the universe led subjects to favour explanations involving God. Conversely, when a compelling religious explanation was offered, this had a significant negative effect on participants’ evaluation of scientific explanations. Preston and Epley (2009, p. 240) conclude: “These data suggest that using scientific theories as ultimate explanation can serve as an automatic threat to religious beliefs, and vice versa.” In an attempt to account for this phenomenon, however, Preston and Epley (2009, p. 240) only considered two possibilities: either the results “stem from an automatic causal discounting”, which means that an argument for one type of cause counts against other causes, and vice versa. This is the option preferred by Preston and Epley. Another possibility is that the results “reflect an awareness of the opposition publicized in the popular culture.” However, neither of these explanations is truly satisfactory, because they beg the question as to why people automatically causally discount either science or religion, or why science and religion are often diametrically opposed in popular culture.

The cognitive predispositions we discussed above provide a more plausible explanation. Religious beliefs make an appeal to our intuitions, whereas science typically flies in the face of those very same intuitions. On a cognitive level, religion and science are thus counteracting forces, pulling in opposite directions. Because they compete for the same explananda, religious and scientific explanations are engaged in a cognitive zero-sum game: if one accepts one type of explanation, one is less likely to find the other type plausible. As a result, religious beliefs enjoy a cognitive advantage over scientific theories, since the former explicitly formulate what people already intuitively endorse (J. L. Barrett, 2010). Although scientific beliefs have a poor agreement with our intuitions, they too often enjoy widespread endorsement, for instance in the media (where the empirical successes of scientific practice are discussed) or in educational contexts (where science is viewed as the best model to understand the natural world). So why do people endorse science in spite of its lack of intuitive attractiveness? As Recanati (1997) has argued, deference to authorities and trust in testimony can lead people to hold beliefs they do not properly understand. For example, many westerners endorse that $E = mc^2$, even though most would be hard pressed to explain mass-energy equivalence. This tension between endorsement on intuitive grounds and endorsement on testimonial grounds may lie at the basis of the popular opposition between science and religion. However, students who do know their science

and accept it need to arrive at a religious understanding that is able to transcend this opposition of science and religion.

9.7 Compatibilism revisited

If, indeed, religious beliefs impede students' understanding and acceptance of evolutionary theory, one might conclude that students need to discard their religious beliefs first in order to arrive at a scientifically informed acceptance of evolutionary theory. Only in the absence of intuitively appealing alternatives, students will be able to override the intuitions that hinder their understanding of purely natural processes. However, religious beliefs are often of great significance, not only to the students personally, but also to the community they live in. Therefore, students will not feel inclined to sacrifice those cherished beliefs for the single purpose of attaining a more correct understanding of the natural world. Hence, we can expect their religious beliefs to be very persistent.

Religious people have tried out several ways to reconcile their faith with an informed understanding of evolutionary theory. The religious faith of founding figures of the modern synthesis, such as Theodosius Dobzhansky and Ronald Fisher, and other expert evolutionary biologists, such as Kenneth Miller and Francisco Ayala, illustrates that such a reconciliation is at least psychologically feasible. Next, we will discuss and evaluate some of the options religious students have taken in order to dissolve the cognitive opposition or tension they experience when they try to integrate a scientifically sound understanding of evolutionary theory with their faith.

One way to relieve this tension consists of putting religious and scientific explanations into a *causal chain* (E. M. Evans, et al., 2011). In this view, at the beginning of the universe, God instigated natural laws through which his creative process unfolds. The processes that take place in the universe are therefore perfectly explicable in terms of secondary (i.e., natural) causes. By taking this position, which is known as theistic evolution, people's intuitive biases are redirected towards a domain of reality on which evolutionary theory is silent. As such, the position indeed allows students to reconcile evolutionary theory with their religious beliefs. However, students who expand their scientific knowledge into domains they had reserved for God, such as Big Bang cosmology, might learn that here too natural processes provide sufficient explanations. In other words, belief in a God who created everything with a Big Bang might be reconcilable with evolutionary theory, but it might not sit so well with scientific

knowledge in other research domains, such as cosmology. For students who are interested in reconciling their religious beliefs with a scientifically informed view on the world, and not just one aspect of it, such a solution might appear entirely ad hoc.

A second option is for students simply to rely on different, even seemingly contradictory explanatory models when trying to make sense of the world, depending on the circumstances they find themselves in. Infants already use different causal inferences when making sense of the behaviour of agents compared to the motions of inanimate objects (Kuhlmeier, et al., 2004). This causal flexibility supports the construction of multiple epistemologies that can be switched on and off depending on the domain (humans, animals, inanimate objects, etc.) people are dealing with (E. M. Evans, et al., 2011). For our purpose, this would mean that a student switches to an evolutionary explanatory model when in the biology class and to a more intuitive model when confronted with religious views in religious education. Hence, by selectively using different kinds of epistemologies, cognitive conflict is avoided. However, not all students will feel comfortable with this solution. Although each of the epistemologies may be internally coherent, they may not always be mutually compatible. This is not to say that people always notice such inconsistencies (Benassi, et al., 1980), nor that they always have the mental resources to resolve them. Indeed, provided that the cognitive distance between different beliefs is sufficiently large, inconsistencies go largely unnoticed and do not call for belief revision. However, Preston and Epley (2009) found that people experience an “automatic opposition” between religious and scientific explanations, which suggests that many students do experience cognitive conflicts between religious and scientific beliefs.

Although these models strive for a psychological integration of religious faith and belief in evolution by natural selection, they may not be satisfactory for all students: the first option reconciles faith and science at the expense of putting them into different time frames, and the second by putting them into different contexts. Students may circumvent these problems by taking a third option, adopting religious beliefs that involve abstract and highly counterintuitive representations of the supernatural (E. T. Lawson, 2005). Such beliefs include the idea that God is not a being, but some sort of “ground of all being”, and other beliefs that do not tap into students’ folk psychology nor other intuitions that would otherwise conflict with their understanding of evolutionary theory. Such a level of theological sophistication may be difficult to achieve and maintain, however, and it may be unclear to students what exactly such religious conceptions boil down to. Barrett and Keil (1996) found that people who subscribe to complex and highly counterintuitive theological theses (e.g., God is ubiquitous) are still caught reasoning about God in everyday situations as if he were a physically and psychologically constrained agent, albeit one with superhuman powers. For instance, while they proclaim to believe in divine omniscience, they implicitly believe that God can only attend to one event at the time. Even after experimenters

confronted their participants with the theological concepts they had explicitly subscribed to, people still continued to anthropomorphize God in most cases. This “theological incorrectness” (Slone, 2004) entails that it will take a lot of pain and effort for students to fully embrace such abstract theological concepts. In fact, abandoning belief in God as a superhuman agent will require serious conceptual change. Before this difficult change is completed, however, it is very likely that even highly counterintuitive God talk will continue to trigger students’ intuitive theory of mind. Even if they understand such highly counterintuitive God concepts, there is a substantial risk that students will simply refuse to accept them, because they conflict too much with their constrained notions of God.

If religious educators were to become aware of the intuitive appeal of many religious representations and of the cognitive constraints that need to be overcome in order to properly understand evolutionary theory, they could help their students considerably. It would be even more helpful if they themselves would actively propagate the kind of highly counterintuitive religious beliefs that do not contravene scientific knowledge. Within some denominations, this is already the case. However, we cannot expect religious educators to be much concerned with the quality of their pupils’ knowledge and acceptance of evolutionary theory.

Much depends on which kind of religion children and adolescents are exposed to. Some denominations put less emphasis on the content of religious beliefs and focus more on religious practices (e.g., the history of particular parts of the liturgy, emphasizing mediation or prayer). Religions having most problems reconciling religious belief with science, such as evangelical forms of Christianity and most forms of Islam, typically hold what Dennett and LaScola (2010) have termed ‘belief in belief’. As they put it “[m]ost people [in these religious communities] believe in belief in God; they believe that it is a state one should aspire to, work strenuously to maintain, and foster in others—and feel guilty or dismayed if one fails to achieve it” (Dennett & LaScola, 2010, p. 125). Given the centrality of this belief in belief for religious believers, the cognitive tension between conflicting scientific and religious beliefs can become very strong, and tilt the psychological balance in favor of religion. By contrast, religions that place more emphasis on practice, such as Judaism, Roman Catholicism or Buddhism, have a higher acceptance of evolutionary theory.

There exists of course a fourth solution, by which students entirely give up their religious beliefs in favour of an exclusively naturalistic worldview. However, given the persistence of religious beliefs and the fact that they are often endorsed by the community students live in, this rarely happens. Nonetheless, the modes of reconciliation we discussed above show that a move towards agnosticism or atheism is not a necessary condition for students to understand and accept evolutionary theory. If students’ religious beliefs are sufficiently malleable to adapt to newly acquired scientific information, this opens important perspectives for science teachers.

9.8 Implications for science education

We can expect that pupils will not modify their beliefs if teachers bluntly confront them with the incompatibility between their faith and evolutionary theory. If they feel that science infringes on religious beliefs that are important to them and their community, students will not feel motivated to study, let alone, accept evolution. A better strategy might be to gradually expose students to experiences and theoretical issues involving evolutionary biology, inducing them to reconsider and revise their religious beliefs. As students learn to appreciate natural selection as a sufficient explanation of biological 'design', they might no longer feel the need to represent God as an intentional agent who has constructed (aspects of) the natural world.

Studies indicate that this can be done from an early age onwards. Although five year old children anthropomorphise God significantly more than their parents do (Shtulman, 2008), they are by that age also able to discriminate between natural and supernatural minds (Knight, et al., 2004; Lane, et al., 2010; Makris & Pnevmatikos, 2007). In a false belief test, five-year-olds know that a normal person will think there are crackers in a box, when the child has been shown that the box actually contains rocks. However, the child assumes that God knows there are rocks inside, despite the misleading package. These findings show that by the age of five children's reasoning about natural and supernatural minds, albeit both anchored in their intuitive psychology, takes different developmental paths. This suggests that, from that age on, children's concepts of God have the potential of being gradually modified into more science-friendly representations, independent of their intuitive psychology.

It is definitely not the task of science teachers to introduce students to particular God concepts (indeed, in the USA this would violate the constitutional separation between church and state). However, science teachers happen to be in a position in which they provide students with experiences and theoretical issues that could induce them to revise their anthropomorphic God concepts. Recent studies suggest that biological education too can start from an early age: even five year old children are able to learn crucial aspects of evolutionary theory such as natural selection (unpublished study, cited in Kelemen, in press). Evans and colleagues (2011, p. 150) describe how "[u]nderstanding the full import of evolutionary theory is a slow process, requiring a series of steps in which the counterintuitive nature of an evolutionary explanation is initially minimized". They propose that the first steps towards such an understanding can be taken from the age of five onwards. It is therefore recommendable that, even in elementary school, pupils are not exclusively exposed to anthropomorphised religious beliefs. Many young children today are exposed to such representations from an early age, in the form of animation movies, jigsaw puzzles and toys featuring the Garden of

Eden or Noah's ark, and children's bibles. Most children are simply not familiar with the alternative, scientific explanations, since evolutionary theory is not taught at the level of elementary (primary) school. Hence the call of some educational psychologists (e.g., Fail, 2008) to incorporate evolutionary theory already at this level. Indeed, a study with Italian children in elementary school has demonstrated that introducing them to evolution has a significant effect on their conceptions concerning the origin of species (Berti, et al., 2010).

9.9 Conclusions

Taking a cognitive perspective on the difficult relation between religion and science education will not resolve all the issues involved. However, the above analysis suggests that cognitive modes of reconciliation are available that allow an informed understanding of evolutionary theory that is not in conflict with one's faith. In particular, by revising their anthropomorphic God concepts into more abstract notions, students will be able to switch off the intuitive modes of reasoning that hinder their understanding of evolutionary theory. This opens interesting perspectives for biology teachers who are confronted with religious students who are reluctant to accept evolutionary theory. They can teach the subject without necessarily posing a threat to the religious beliefs of their students. It goes without saying that science and biology teachers cannot impose a particular religious view on their students. However, they can gradually provide them with experiences and theoretical issues that might motivate them to adapt their beliefs to the newly acquired information. The earlier they do this, the better.

Chapter 10

Dealing with creationist challenges. What European biology teachers might expect in the classroom¹

Abstract

Creationists are becoming more active in Europe. We expect that European biology teachers will be more frequently challenged by students who introduce creationist misconceptions of evolutionary theory into the classroom. Moreover, research suggests that not all teachers are equally well prepared to deal with them. To make biology teachers aware of what they might be confronted with, we discuss three kinds of misconceptions that are common in creationist literature: misconstruing scientific methodology, making a straw man out of evolutionary theory, and demanding unreasonable evidence. We offer some suggestions as to how to deal with them, but we also note the importance of embedding this approach in a more comprehensive educational program in which students learn to think critically and in which their moral concerns and worldview are taken into account. In addition, we invite biology teachers to reflect on

¹ This chapter has been accepted for publication in *Journal of Biological Education* (Blancke, Boudry, et al., in press). Parts of this paper were presented at the *Religious responses to Darwinism, 1859-2009* conference at St-Anne's College, Oxford and at the *150 years after Origin: biological, historical, and philosophical perspectives* conference at Victoria College, University of Toronto.

their own knowledge and, if necessary, to refresh it by consulting accessible yet scientifically informed literature. Although our main concern lies with teachers in Europe, our approach might be valuable to biology teachers worldwide.

10.1 Introduction

Although creationism, be it of the young-Earth, old-Earth or Intelligent Design variant, and resistance to evolutionary science are still widely considered to be exclusively North American phenomena, they have evolved into a significant global movement over the last decades, including Europe (Blancke, 2009a, 2010; Cornish-Bowden & Càrdenas, 2007; Graebisch & Schiermeier, 2006). Consequently, in 2007 the Council of Europe warned against “the danger of creationism in education” (Parliamentary Assembly of the Council of Europe, 2007). We are concerned that in years to come European biology and science teachers will be confronted more frequently with creationist challenges posed by their students, due to the increasing visibility of creationists within the public sphere, intensified creationist propaganda and persistent cognitive impediments for understanding evolutionary science.

10.2 Educational background and motivation

Numerous studies suggest that students hold many misconceptions about evolution and its main mechanism, natural selection (for an overview, see Gregory, 2009). Other studies suggest that students’ misconceptions of the nature of science can impede their understanding and acceptance of evolutionary theory (Hokayem & BouJaoude, 2008; Lombrozo, et al., 2008). Importantly, these frustratingly persistent misconceptions (Bishop & Anderson, 1990) might be due to cognitive predispositions that are hard to overcome by instruction (De Cruz & De Smedt, 2007; Kelemen & Di Yanni, 2005). Several of these cognitive predispositions are more in line with creationism than with evolutionary theory. For instance, the tendency to misidentify purpose (teleology) in the living world naturally develops in young children and laypeople, without need of

explicit instruction. However, around the age of ten, children undergo a cognitive shift by which they become more inclined to prefer natural over teleological and creationist explanations for phenomena in the natural world (E. M. Evans, 2000b; Kelemen & Di Yanni, 2005). These findings suggest that educational efforts towards understanding of evolution may be better targeted at children over ten years old. However, even after making this cognitive shift, children (and adults) may still be prone to teleological explanations of nature, and thus susceptible to misconceptions about evolution. For example, some studies (e.g. Kelemen & Rosset, 2009) show that even educated adults continue to make incorrect teleological inferences when put under time pressure, endorsing statements like “Earthworms tunnel underground to aerate the soil”.

In light of the cognitive preference for teleological explanations, and the pervasiveness of creationist propaganda fueling these misconceptions, we think it is important for teachers to actively engage with prior beliefs and misconceptions brought to the classroom, demonstrate how and where these go wrong and explicitly replace them with scientific concepts (Alters & Nelson, 2002; Cunningham & Wescott, 2009; Gregory, 2009). As Verhey (2005, p. 997) puts it: “[S]tudents must ‘unlearn’ before they can learn.” We argue that misconceptions about evolutionary theory and about the nature of science need to be addressed in the same breath, by confronting students with empirical evidence and by providing analogies that clarify the nature of scientific inference. In this way, students not only experience evolutionary theory as proper science (Nelson, 2007), but they also gain direct access to the way science works (Pennock, 2004).

Unfortunately, however, studies consistently show that teachers – even biology teachers – hold misconceptions similar to the ones entertained by students (Rutledge & Mitchell, 2002; Rutledge & Warden, 2000). Moreover, some studies indicate that up to 50 percent of the teachers finds it hard to accept the place of evolutionary theory in the science curriculum, preferring to “balance” it by teaching creationism, or to leave evolution out of their classes altogether (Nehm, et al., 2009; Nehm & Schonfeld, 2007). This is not only the case in the USA. Research in South Africa and the UK suggests similar attitudes in teachers. They, too, hold many misconceptions about science in general and evolutionary theory in particular. For instance, they consider the word theory to denote an educated guess or they think humans have evolved from apes and monkeys. This leaves them highly vulnerable to creationist propaganda (Cleaves & Toplis, 2007; McCrory & Murphy, 2009; Sanders & Ngxola, 2009). It seems that not all teachers are well prepared to deal with possible creationist challenges.

In this article, we do not intend to offer a catalogue of common misconceptions (for such a list, see e.g. Gregory, 2009). Instead, we will discuss three major *kinds* of misconceptions creationists repeatedly level against evolutionary theory. First, creationists question the scientific status of the *methodology* of evolutionary theory.

Second, they misconstrue the *content* of the theory to make it easier to discard. Third, they demand *evidence* evolutionary scientists cannot deliver in principle.

Some creationist organizations have openly and actively motivated students to introduce these kinds of misconceptions in the classroom (Wells, n.d.). Due to the intensified creationist propaganda in several parts of Europe, we think European teachers can increasingly expect to find themselves challenged by exactly these kinds of misconceptions in the classroom. As European science teachers may be less familiar with typical creationist fallacies, we consider it important and even necessary to provide a general overview of this problem. If teachers are aware of the most common misconceptions, they can prepare themselves to deal with them adequately. Therefore, we will illustrate each misconception with at least one example and offer some suggestions as to how to deal with them.

We fully realize that simply addressing and correcting these misconceptions concerning evolutionary theory, science and evidence, will not suffice for making creationist students understand and accept evolutionary theory. One obvious difficulty is that some biology teachers also endorse creationism to some extent. These teachers have what Kitcher (2008) has termed hybrid epistemologies – they accept the bulk of scientific knowledge about anatomy, ecology, and so on, but let themselves be guided by religious convictions in the case of evolutionary theory. However, the problem of creationism in biology teachers falls outside the scope of this paper, since we focus on the challenges encountered by teachers who try to bring evolutionary theory across. In order to adequately deal with this resistance, teachers would also have to improve students' reasoning skills (A. E. Lawson & Weser, 1990; A. E. Lawson & Worsnop, 1992), address their moral concerns (Lombrozo, et al., 2006; Wilson, 2005), and take their worldviews and religious opinions into account (Anderson, 2007; Reiss, 2009; Schilders, et al., 2009). However, one can only accept a theory if it is properly understood, so our account at least provides a first step towards addressing this problem. Moreover, teaching usually is a social event. Even if students with solid creationist beliefs are not so easily convinced, the misconceptions they raise might spark confusion in the minds of other, less religious students, if they are not properly dealt with. Or perhaps a student just wants to challenge the teacher with a creationist argument he or she picked up elsewhere. If these arguments are ill-addressed, or remain unaddressed, then this might have a negative effect on the students' understanding and acceptance of evolutionary theory. Therefore, dealing with misconceptions may not always be sufficient to counter creationist beliefs, but it most certainly is a necessary condition for teaching evolutionary science more efficiently,

10.3 The science behind evolutionary theory

“Evolution is not truth; it is merely an hypothesis – it is millions of guesses strung together. It had not been proven in the days of Darwin (...). It had not been proven in the days of Huxley, and it has not been proven up to today.” (Bryan, 2007, p. 158) These words were written by William Jennings Bryan (1860-1925) in 1925 as part of the summary argument he intended to present at the end of the famous Scopes trial. Due to circumstances, he did not get the chance to read it out loud (Larson, 1997). Nonetheless, this quote is a clear expression of an objection that creationists have repeatedly raised against evolutionary theory: evolution is not science, because its methods are unsound. Bryan’s objection was not new (Rudolph & Stewart, 1998). When Darwin published his *On the origin of species* in 1859, he received a wave of criticism that doubted the validity of his methods. Among his critics were the most important philosophers of science of that time, John Herschel, William Whewell and John Stuart Mill. They considered the inductive method set out by Francis Bacon and exemplified by Newton’s physics as the hallmark of proper science (Hull, 2009; Rudolph & Stewart, 1998). This means that one observes events and conducts experiments without any preconception and makes generalizations from the data generated by those observations and experiments. Herschel, Whewell and Mill rejected Darwin’s theory because he had abandoned the strict Baconian approach – Darwin’s ideas might make for good hypotheses, but they were not proven at all (Hull, 2009).

Contemporary philosophers of science (e.g. Pennock, 1999) and scientists (e.g. Ayala, 2009) agree that Herschel and Whewell had taken too strict an approach to the inductive method. Ironically, Darwin’s “one long argument” in *On the origin of species* is now considered as one of the greatest examples of what Whewell himself termed a “consilience of induction”. In spite of these developments in the philosophy of science, some creationists, especially of the young-Earth variant, still defend the outdated notion of science as a strictly inductive endeavor. Henry Morris (1974a, p. 4) wrote that “it is impossible to prove scientifically any particular concept of *origins* to be true [...] the essence of the scientific method is experimental observation and repeatability.” Duane Gish (1978, p. 13), a renowned creationist debater, remarked that

for a theory to qualify as a scientific theory, it must be supported by events, processes, or properties which can be observed [...] no one observed the origin of the universe, the origin of life, the conversion of a fish into an amphibian, or an ape into a man. No one, as a matter of fact, has ever observed the origin of a species by naturally occurring processes. Evolution has been *postulated*, but it has never been *observed*.

It seems that creationists will only be convinced if they are put in a time machine and actually witness macro-evolutionary change. To see just how strange this requirement is, think of a detective arriving at a crime scene (Dawkins, 2009). Of course, the detective did not actually witness the murder, but from the fact that there is a dead body lying on the ground with a knife stabbed in its back, he can reasonably and safely infer that a murder has taken place. On the basis of other clues he infers that the perpetrator forced his or her entry in the room (glass of one of the windows is scattered on the floor), that he or she is left-handed (from the angle by which the knife has entered the body), etc. The reasoning of scientists is actually very similar. Like a clever detective, Darwin (1859) inferred from the geological record, the geographical distribution of species, homologies, vestigial and rudimentary organs, and embryological data that life on earth evolved by natural selection. Since then, this conclusion has been continuously confirmed by new evidence, like molecular biology or genetics. However, creationists have one advantage; their model of science appeals to a conception of science entertained by students themselves and the public at large. In this view, science is about doing experiments in laboratories and making direct observations. Even the educational system tends to propagate this outdated model of science, with its emphasis on technology and laboratory work (Rudolph & Stewart, 1998). Presenting evolutionary theory as good detective work might facilitate students' understanding of how science in general is conducted and help them accept evolutionary theory as proper science. Analogies from everyday experience like these may help students appreciate how the available evidence bears on a scientific hypothesis.

10.4 Evolutionary theory

Creationists not only misunderstand and misrepresent the methodology that supports evolutionary theory, they also make a straw man out of evolutionary theory itself. For instance, evolution is invariably equated with mere 'chance'. According to creationists, believing in evolution amounts to believing that, in the image of Fred Hoyle, one can get a Boeing 747 by letting a tornado whirl through a junkyard. Henry Morris (1974b, p. 156), for instance, wrote that "[t]he essence of evolution, of course, is randomness. The evolutionary process supposedly began with random particles and has continued by random aggregations of matter and then random mutations of genes."

A more recent passage is found in *The evolution deceit*, written by the Turkish creationist Harun Yahya (1999, p. 158):

Evolutionary theory asserts that life is formed by chance. According to this claim, lifeless and unconscious atoms came together to form the cell and they somehow formed other living things, including man. Let us think about that. When we bring together the elements that are the building-blocks of life [...] only a heap is formed. No matter what treatment it undergoes, this atomic heap cannot form even a single living being. If you like, let us formulate an “experiment” on this subject [...]: Let evolutionists put plenty of materials present in the composition of living beings [...] into big barrels. [...] No matter what they do, they cannot produce from these barrels [...] giraffes, lions, bees, canaries, horses, dolphins, roses, orchids, lilies, [...], or millions of other living beings such as these. Indeed, they could not obtain even a single cell of any one of them.

Harun Yahya – actually the name for a writers collective led by Adnan Oktar – replaces the image of a junkyard with a barrel, but the idea behind it remains the same. The analogy conveys the message that evolutionary theory says that complex phenomena in nature arise by chance, and chance alone: stir up the elements a bit, and you get wonderful complex organisms.

The equation of evolution with mere chance is also essential for the case of Intelligent Design proponents. It seems to make their explanation of biological functional complexity in terms of an intelligent designer much more plausible. An important part of the defense of “irreducible complexity” – the notion distilled from creationist literature from the 1980s by Michael Behe in his book *Darwin's Black Box* (1996) – rests on the assumption that evolution occurs by pure chance. Behe argues that the bacterial flagellum [the bacterium's tail] has to come about all at once. Of course, given the complexity of the flagellum, this is a very unlikely event, which induces Behe to infer an intelligent designer. The flagellum is actually Behe's Boeing. William Dembski, the other main theorist of Intelligent Design, introduced an “explanatory filter” to detect instances of design. However, if one takes a closer look at the filter Dembski puts forward, it becomes clear that he simply ignores the possibility of natural selection. The filter jumps from ‘necessity’ (explaining something by referring to a natural law) over chance to design as possible explanations of natural phenomena (Dembski, 1999). But as critics of creationism have pointed out repeatedly, natural selection is the opposite of chance: functional complexity occurs through the interplay of chance *and* necessity. Evolution is the *non-random* selection of *random* variations and mutations. A good pedagogical illustration of the crucial difference between pure chance and cumulative selection is given by Richard Dawkins' WEASEL-program (Dawkins, 2006 [1986]). The odds against a computer producing METHINKSITISLIKEAWEASEL, a phrase from Shakespeare's *Hamlet*, in one shot – i.e., by pure chance – is 26^{23} to 1, a very small probability. But if one allows the computer to preserve the right letters on the correct places at each attempt, it will need no more than 23×26 (= 598) attempts to get to this sentence (Dawkins, 2006 [1986]).

Students often have difficulties understanding the proper role of chance in evolution by natural selection, and it is therefore instructive to use illustrations like these. It will also make students less vulnerable to creationist obfuscations. Experimental evidence (e.g. G. Gigerenzer & Edwards, 2003) indicates that people unfamiliar with probability theory make persistent errors when they have to calculate the probability of single events. Even medical doctors erroneously think that, if a breast cancer screening has a reliability of 80 %, this means that, of all people with positive screening results, 80 % actually have breast cancer. This completely ignores the base rate of breast cancer incidence in a population, and the possibility of false positives. However, when probability is formulated in terms of frequencies, rather than single events, laypeople perform much better. In this case, they heard the following scenario: 10 out of 1000 women over 40 have breast cancer. 8 of those 10 with breast cancer will test positive; 99 of the 990 women without breast cancer will also test positive. How many of those who test positive, actually have breast cancer? This time, about half of the participants arrived at the correct response, which is about 8 %.

When people think about adaptations in singular terms (e.g., a single structure coming into existence in Harun Yahya's barrel, the bacterial flagellum), we can likewise expect them to make incorrect inferences about the probability of such structures coming into existence. Teachers can avoid these incorrect inferences by stressing the gradual and cumulative retention of favorable variations and by explicitly representing natural selection in terms of natural frequencies, for instance, in terms of populations with natural variation (De Cruz, 2009). The adaptive change in fur coloration in deer mice (*Peromyscus maniculatus*) is a pertinent example: due to the emergence of sand hills in their habitat during the past 10,000 years, the normally brown deer mice became more visible to birds of prey, which led to the spread of a rare light coat coloration mutation, which is now common in the population (Linnen, et al., 2009).

10.5 Evidence

The issue of evidence has already come up in the previous sections, as the kind of evidence one demands for a theory naturally depends on one's understanding of that theory and the evidence in its support. We mentioned that creationists ask for a film of evolution, from molecule to man, because they insist that is the way proper science should be done. Ken Ham, president of *Answers in Genesis* (the largest American young-Earth organization), keeps urging young children to ask their teacher: "Were you

there?” whenever they are taught evolutionary theory. If science indeed has to proceed the way creationists think it should, evolutionary scientists would have to come up with direct observations of macro-evolution – this would be like asking a historian to show Julius Caesar actually crossing the Rubicon river or a particle physicist to directly demonstrate the existence of elementary particles. However, scientists can rely on other sources of evidence to support their conclusions, such as fossils or comparative studies of genomes.

Because creationists equate natural selection with pure chance, they want to see complex functional traits – the eye, the defense mechanism of the bombardier beetle, the bacterial flagellum – emerge in an instant. Harun Yahya challenges scientists to stir a molecule soup as long as they want, and see if they are able to obtain us a single living cell, let alone a species. But since evolutionary scientists never think of natural selection as a purely random process, they find Yahya’s experimental challenge completely irrelevant.

Two more examples will show just how unreasonable some of the creationist demands for evidence are. In his book *The edge of evolution* (2007), Michael Behe mentions research conducted with yeast that showed massive gene duplication occurring within a common yeast ancestor. Gene duplication is considered a main source of new material for natural selection to work with. When a gene that is necessary for the development of a particular phenotypic feature gets doubled within the genome, the copy of the gene *might* evolve to perform something interesting itself, given a bit of luck and a selecting environment. It *might*, but nothing in evolutionary biology says it has to. On the contrary, it is much more likely that the second, unnecessary gene will remain inactive. In this case, within some species of yeast, the whole genome was duplicated at once. According to Behe, this surely is a huge opportunity for natural selection to demonstrate its craftsmanship. However, as he noted (Behe, 2007, p. 74), nothing really interesting happened. From which he concludes that “[r]andomly duplicating a single gene, or even the entire genome, does not yield new complex machinery; it only gives a copy of what was already present.”

Of course, duplicating a gene only yields a copy of a gene already present. That is exactly what gene duplication means. Behe, however, wants this process to bring about complex features at a stroke. He seems to believe that natural selection *always* has to come up with something new and complex and that, if it doesn’t, the creative power of natural selection is proven to be ineffective. But scientists *know* that gene duplication by itself does not produce complex features and evolutionary biologists do not pretend otherwise. Natural selection is about adapting organisms to their environment, and that doesn’t always mean making them more complex.

It may seem unlikely that students will come up with this sort of sophisticated arguments in the classroom, but on the other hand, the example highlights two common misconceptions concerning evolutionary theory and the evidence supporting

it, which students may well bring into the classroom: (1) the equation of evolution with mere chance; and (2) the idea that natural selection invariably *has* to come up with novel adaptive complexity. The misconception of evolution as some kind of unrelenting progression, usually with humans at the end, is very persistent. In order to tackle these misconceptions, teachers should be constantly aware of what the theory of evolution by natural selection actually predicts, and how the evidence relates to the theory.

Next to this, creationists frequently refer to the supposed “gaps” in the fossil record, asking for the “missing links” that could fill them. Although fossils are only formed and preserved in rare circumstances, paleontologists have found plenty of fossils of transitional species: *Archaeopteryx*, for instance, illustrates the transition from dinosaurs to birds; the recently discovered *Tiktaalik rosae* sheds light on the transition from aquatic to terrestrial animals; and *Australopithecus afarensis* illuminates the evolution of bipedalism in hominids. Although it is unlikely that one of these fossils is a direct ancestor of extant species, they do show how features of modern species gradually evolved out of earlier adaptations. For instance, *Archaeopteryx* had feathers, but it also had a tail, claws and teeth that the animal shares with dinosaurs. Creationists, however, are not at all satisfied with this evidence. Duane Gish (1978, p. 90), for instance, replies that *Archaeopteryx* is clearly a modern bird: “[I]t had wings, it was completely feathered, it *flew*. It was not half-way bird, it was a bird.” Ad hoc explanations are then presented to account for the reptilian features. For example, Gish points out that claw-like appendages on wings can still be found in birds living today, so why would there not be birds with such features in the past? It is important for teachers to be able to explain exactly how transitional species constitute evidence for evolutionary theory and why these creationist remarks are completely mistaken. Claw-like appendages of modern birds do not contradict, but actually confirm, the reptilian ancestry of birds. The recent find of the feathered and probably flightless small dinosaur (theropod) *Anchiornis huxleyi*, which significantly predates *Archaeopteryx*, adds further evidence for the gradual evolution of birds from reptiles (Hu, et al., 2009). It is important for teachers to have some knowledge of the available fossil evidence and to realize that, whenever there is a purported gap in the paleontological record, this does not entail the decline of evolutionary theory (Coyne, 2009; Dawkins, 2009).

10.6 Implications for education

To be sure, we realize that merely addressing students' misconceptions will not suffice to teach evolutionary theory properly. Correcting their mistakes will not make students suddenly change their mind. Therefore, this approach should be embedded in a comprehensive program in which students not only learn to think critically, but in which their worldview and moral concerns are also taken into account. It is one thing to give people the freedom to choose their personal (religious) worldviews, but quite another thing to offer them substandard scientific education, as when teaching Intelligent Design alongside evolutionary theory. We believe that confronting students with their misconceptions in the scientific domain and explicitly replacing these misconceptions with correct alternatives is a vital part of good science education. Tolerance of beliefs that clash with scientific knowledge (such as the authority that evangelical Christians accord to the Bible) is not to be confused with giving equal time to controversial and unscientific material. Thus, teachers can express tolerance for such alternative worldviews, but indicate that they have no place in the biology class.

Ideally, strategies for dealing with creationist challenges should be supplied during teacher training. This would involve introducing future biology teachers to the way science works, and making them familiar with the overwhelming evidence for evolutionary theory. For instance, introducing philosophy and history of science in the curriculum of future teachers might be helpful to give them a feel for the way science works, and for the relationship between theory and evidence in scientific practice. Teachers should be on the lookout for analogies from everyday experience to transmit concepts that are intuitively difficult to grasp, such as the combination of chance and necessity in natural selection. Finally, biology teachers could get regular updates on new empirical findings that support evolutionary theory, for instance in the form of websites explicitly aimed at them (see e.g., www.evolutietheorie.be for an example in Dutch or http://www.bbc.co.uk/sn/prehistoric_life/dinosaurs/ for the United Kingdom). In practice, however, we think it is also important for biology teachers to be aware of the risk of being challenged in the classroom. We would advise them not to take their own knowledge for granted, and to refresh their understanding of the methodology of science, evolutionary theory, and the evidence supporting it. This can be achieved by consulting one or two excellent popular scientific works like Coyne (2009), Dawkins (2009), or Shubin (Shubin, 2008). These can supply teachers with the necessary information to adequately deal with students' misconceptions.

General conclusions

With this dissertation, I intended to realize three different but intimately connected goals. First, I wanted to demonstrate that creationism is not a phenomenon that is restricted to the American Bible Belt or to the Islamic world. Creationism is to be found right at our doorsteps. Sometimes, it takes the form of activities organized by creationist groups or collaborations between them, which are supposed to reach the public at large and are therefore highly visible. The Dutch leaflet campaign that I discussed in chapter 5 is just one example of such activist creationism. Mostly, however, creationism remains silent because it is situated at a local level within smaller communities, where creationist beliefs are barely explicated and simply taken for granted. This naive or intuitive creationism is only brought to the fore when the media becomes alarmed by creationist beliefs being propagated within a particular community or school, or by quantitative studies that probe for people's acceptance of evolution. The presence of intuitive or naive creationism probably explains the discrepancy in Flanders between the low level of creationist activism and the fact that quantitative studies so far suggest that ten to twenty percent of the population has difficulties accepting evolution.

Second, because in recent years creationist activism has been on the rise in Europe, and has even been able to exert considerable influence on political processes both at a national and a European level, creationism has drawn the attention of an increasing number of European scholars. However, the review of the literature on European creationism in chapter 3 demonstrated that a systematic approach to the subject is still very much under construction. With this dissertation, I hope to have provided material and lend support to this larger work-in-progress. Third, not only did I intend to make a modest contribution to the understanding of creationism in Europe, but also, because the research is still in its infancy, offer some methodological suggestions as to how this research could be conducted. It should be clear by now that I prefer an integrated

approach, in which different aspects of creationism in Europe are studied from different angles and then incorporated into a larger body of knowledge. As such, we will be able to take a comprehensive look at creationism in Europe and come to understand the phenomenon in many of its dimensions.

Fortunately, an integrated study of creationism in Europe does not need to be built up from scratch. Much can be learnt from gleaning across the Atlantic and seeing how creationism has been studied in the United States. American creationism has been the subject of historical, sociological, cognitive, philosophical, theological, educational and scientific studies, all of which are certainly to be taken into account. However, the distinct politico-geographical, cultural, religious, historical and constitutional contexts of the European continent require a specific approach, attuned to these particular circumstances. Because these circumstances tend to differ from one country to another, such an approach will often depend on transnational collaborations, both among European and with American scholars. Bringing together studies from different countries, each with its own peculiarities, and from different fields of research, will create unique opportunities to compare a large variety of contexts and thus to establish which factors, and to what extent, have a significant impact on the distribution and popularity of creationist beliefs.

I have developed three perspectives, each of which highlight an essential aspect of creationism in Europe. In the first section, I adopted a historical approach. The first two introductory chapters offered a brief account of the history of creationism and Intelligent Design in the United States. Getting a grasp of this history is absolutely indispensable if we want to arrive at a comprehensive historical understanding of the phenomenon in Europe. American creationists have invested a considerable amount of energy into disseminating their beliefs across Europe, either by actively proselytizing, like in most Eastern European countries after the Cold War, or by meeting the demands of local creationists, like, for instance, in Turkey and the Netherlands. As a consequence, several elements of American creationism have been imported into European cultures, or subcultures. Still, the American brand of creationism is generally not accepted wholesale, and is appropriated to serve particular local needs. In Turkey, the “creation science” of the Institute for Creation Research became incorporated into the political agenda of conservative Muslims. The introduction of Intelligent Design into evangelical and orthodox communities in the Netherlands soon proved that its potential to wedge itself into creationist (sub)cultures, rather than into the mainstream, modernist culture, should not be underestimated. These developments however can be only be properly understood if we apprehend how and why American creationism has evolved the way it did, identify the distinctly American elements in European creationism, and establish how they adapt to the conditions set by these new European environments.

In the third chapter, I reviewed the literature concerning creationism in Europe. Such a review proved important for two reasons. Firstly, because it assembles all the available

material on the subject of creationism in Europe, the review offers a good starting point for further research. It decisively demonstrates that creationism in Europe should indeed be reckoned with. It also points out where creationism is most likely to be found and gives a taste of the complexity of the subject. Furthermore – and this takes me to the second reason – such a review allows us to put a finger on what is missing from the literature and thus helps to identify the kind of research that is most urgent. A comprehensive historical study of creationism in Europe is one of those studies that should be undertaken. As I have mentioned in chapter 3, arrangements have been made with John Hopkins University Press to publish an edited volume on this very subject.

Chapter 5 and 6 lay the groundwork for my personal contribution to this exciting project. In chapter 5, I discuss the recent history of creationism in the Netherlands. In chapter 6, I recount the most remarkable incidents relating to creationism and antievolutionism in Flanders, concluding with a discussion of the possible explanations that might account for the difference in activist creationism between the two countries. One explanation that immediately comes to mind is that in the Netherlands we find rather large orthodox Calvinist and evangelical communities, whereas in Flanders Roman Catholicism has been the main denomination for centuries. Although I considered this explanation plausible to a certain extent, it certainly needs some qualifying. After all, on the one hand, some Roman Catholic individuals or groups are strictly creationist, and, on the other hand, certainly not all orthodox Protestants and evangelicals are creationists. The suspicion that the correct explanation was probably not that straightforward led me to consider the history of catholic responses to evolution and evolutionary theory, which I relate of in chapter 4. This study shows that the Vatican long opposed the accommodation of catholic faith with evolution and that it still has not come to terms with evolutionary theory. The reconciliatory position the catholic church assumes today is therefore not so much the result of an initiative taken by the Vatican itself, but rather of its incapability to silence the voices of those catholic intellectuals who defended the compatibility of their faith with evolution. One determining factor in that regard is that, in many European countries, Catholicism was not confined to the margins of society. Instead, it played an important role in mainstream culture, where it was forced to adapt itself to an increasingly secular environment. Accepting the accomplishments of modern science is simply one important element in such an accommodation.

In the Netherlands, mainstream Protestantism too has since long made its peace with modern science, including evolution. A minority of evangelicals and conservative Protestants however has retreated to their own subculture, which provides them with a safe seclusion from disturbances by secular society. Within their own communities, they feel less pressure to adjust their religious beliefs to mainstream culture. Moreover, the evangelical and orthodox subculture can rely on its own broadcasting company, the EO, and its own schools, both of which are funded by the state. Like in Flanders, creationism

remains mostly unarticulated in these communities, because the members consider it self-evident. Nevertheless, when the most conservative elements get the feeling that their shared values and beliefs are under threat, either by developments in the outside world, like in the Darwin year, or by the “apostasy” of their own authority figures, like Dekker and Knevel, the minority is sufficiently large and organized to take a firm stance on creationism and make itself heard, even beyond the confines of its own community. This particular situation in the Netherlands stands in stark contrast to Flanders, where the minorities favourable to creationism do not have the numbers nor the means to cause much of a stir. Hence, taken together with a Catholic church that has adapted to a secularised mainstream culture, creationist activism is almost entirely absent in Flanders. To sum up, the difference in religious denominations only partly accounts for the difference in creationist activism between the Netherlands and Flanders. A proper explanation needs to be complemented with other factors, including the position of religious groups vis-à-vis secular culture and the size and the means of communities valuing creationist beliefs.

The second section explores the potential benefits of taking a philosophical perspective on creationism in Europe. In the United States, a number of philosophers – Robert Pennock, Michael Ruse, Philip Kitcher, Massimo Pigliucci and Barbara Forrest, to mention but a few – have made widely appreciated contributions to the understanding of creationism. Not only have they elucidated what creationism stands for both as a movement and a worldview, but they have also tirelessly engaged with the misconceptions creationists hold about morality, the nature of science, evolutionary theory and a lot of other important issues. For instance, creationists often confuse different meanings of a single concept. The claim that evolutionary theory is “just a theory” only makes sense if one uses “theory” in its colloquial sense of “hunch” or “hypothesis”, but not in its scientific sense (Scott, 2008). Several equivocations in the concept of irreducible complexity have allowed Michael Behe and his ID fellows to evade criticism on this purported criterion of “design” (Boudry et al., 2010). In chapter 7, we discussed yet another example of how critics of evolutionary theory tend to run off with the double meaning of words. On the basis of the first No Free Lunch theorem, Ronald Meester has argued that simulations of evolution by natural selection cannot demonstrate the creative power of natural selection, because such simulations are either directed at a target or designed with a particular purpose in mind, or both, and therefore intrinsically teleological. However, Meester confuses several meanings of the term “teleological”. If one carefully distinguishes between these different meanings, it becomes clear that the “teleological” character of simulations of evolution does not pose a problem for using those simulations to demonstrate and, as such, attain a better understanding of, real life biological processes.

In chapter 8, I explored how the popularity of pseudosciences in general can be partly explained by the intuitive appeal they have for the human mind. In particular I

demonstrated how creationist beliefs are anchored in essentialist, teleological and intentional intuitions, by which they gain a significant cognitive advantage over the more rational or scientific beliefs propounded by evolutionary theory. Indeed, creationism is a lot more easier to apprehend and to memorize than evolutionary theory, which, in turn, explains why it spreads so easily. In recent models of cultural evolution (e.g. Sperber, 1996), cultural and cognitive biases play an important part in accounting for the popularity of particular representations or beliefs within cultures. These models also apply to creationism. Therefore, if we want to understand the distribution of creationist beliefs across Europe, it will be important to incorporate both the universal intuitive appeal of those beliefs and the particular cultural representations that either impede or facilitate their dissemination. As such, we can expect creationist beliefs to be far more popular in Europe than the size of creationist communities would incline us to believe. If those beliefs do not find their expression into culturally available representations, it will be interesting to see which historical, sociological, intellectual, religious and educational factors have prevented this. The cognitive aspect need not be always included in the analysis of the interaction of creationist beliefs and particular contextual factors. However, if we acknowledge that peculiarities of the human mind play a central role in the development and dissemination of creationism, then our understanding of creationism can also be integrated with the available knowledge concerning the evolved human mind. As such, the study of creationism in Europe would substantially add to the understanding of cultural phenomena in general.

In the first chapter of the third section, chapter 9, I expanded the cognitive perspective to an analysis of the relation between science education and religion. I argued that not just creationist, but religious beliefs in general, are constrained by essentialist, teleological and intentional intuitions. As these intuitions have been found to impede the learning and understanding of evolutionary theory, we can expect religious beliefs to exert a negative influence on the learning and acceptance of evolutionary theory as well. Nevertheless, students seem to be able to reconcile their religious beliefs with an informed acceptance of evolutionary theory in a variety of ways, which opens interesting perspectives for biology teachers. Children's understanding of supernatural minds is anchored in their intuitive psychology. Biology teachers, however, are well-positioned to provide students with experiences and theoretical issues that might induce them to revise their concepts of the supernatural in such a way as to become compatible with evolutionary theory. In chapter 10, I discussed another issue biology teachers encounter in the classroom. Because of the rise of creationist activism, European biology teachers are increasingly confronted with creationist challenges. I explained that creationist arguments generally depend on misconceptions about the nature of science, the scientific status of evolutionary theory and the evidence supporting it. Since creationism is not (yet) as common in Europe as in the United

States, European teachers might be particularly unprepared to address these misconceptions. In the short run, they can remedy this problem by consulting a popular science book on evolution. In the long run, however, strategies for dealing with creationist challenges should be provided for during teacher training.

I would like to conclude this dissertation with an anecdote. When my fiancée and I had just moved into our new apartment, a police officer came round to check whether we actually lived there. We offered him a drink and as he sat down at our table, we started talking. At one point, he asked me what I did for a living. I explained to him that I was a PhD candidate in the Department of Philosophy at Ghent University and that I was doing research on creationism, when the man asked me: “Is that larger than a cow?”. By using this Flemish expression, the good man only meant to say that he had never heard of creationism. However, it did make me wonder whether, of course, in the most metaphorical sense possible, creationism in Europe was indeed “larger than a cow”. I think that this dissertation has shown that creationism in Europe is indeed a socio-religious phenomenon that is not to be neglected.

Bibliography

- Allgaier, J. (2010). Scientific Experts and the Controversy About Teaching Creation/Evolution in the UK Press. *Science & Education*, 19(6), 797-819.
- Allgaier, J. (in press). Networking expertise: Discursive coalitions and collaborative networks of experts in a public creationism controversy in the UK. *Public Understanding of Science*.
- Allgaier, J., & Holliman, R. (2006). The emergence of the controversy around the theory of evolution and creationism in UK newspaper reports. *Curriculum Journal*, 17(3), 263-279.
- Alters, B. J., & Nelson, C. E. (2002). Perspective: Teaching evolution in higher education. *Evolution*, 56(10), 1891-1901.
- Anderson, R. D. (2007). Teaching the theory of evolution in social, intellectual, and pedagogical context. *Science Education*, 91(4), 664-677.
- Appleby, R. S. (1999). Exposing Darwin's "hidden agenda": Roman Catholic responses to evolution. In R. L. Numbers & J. Stenhouse (Eds.), *Disseminating Darwinism. The role of place, race, religion, and gender* (pp. 173-207). Cambridge: Cambridge University Press.
- Arnould, J. (1996). *Les créationnistes*. Paris: Cerf/Fides.
- Arnould, J. (2007). *Dieu versus Darwin. Les créationnistes vont-ils triompher de la science?* Paris: Albin Michel.
- Artigas, M., Glick, T. F., & Martínez, R. A. (2006). *Negotiating Darwin: the Vatican confronts evolution, 1877-1902*. Baltimore: Johns Hopkins University Press.
- Artigas, M., Glick, T. F., & Martínez, R. A. (2008). Darwin and the Vatican: the reception of evolutionary theories. In E.-M. Engels & T. F. Glick (Eds.), *The reception of Charles Darwin in Europe* (Vol. II, pp. 413-429). London: Continuum.
- Atran, S. (1994). Core domains versus scientific theories: evidence from systematics and Itza-Maya folkbiology. In L. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind. Domain specificity in cognition and culture* (pp. 316-340). Cambridge: Cambridge University Press.
- Atran, S. (2002). Modular and cultural factors in biological understanding: an experimental approach to the cognitive basis of science. In P. Carruthers, S. P. Stich & M. Siegal (Eds.), *The cognitive basis of science* (pp. 41-72). Cambridge: Cambridge University Press.
- Ayala, F. J. (1970). Teleological explanations in evolutionary biology. *Philosophy of Science*, 37(1), 1-15.

- Ayala, F. J. (2009). Darwin and the scientific method. *Proceedings of the National Academy of Sciences of the United States of America*, 106(Supplement 1), 10033-10039.
- Bardapurkar, A. (2008). Do students see the "selection" in organic evolution? A critical review of the causal structure of student explanations. *Evolution. Education and Outreach*, 1(3), 299-305.
- Barrett, H. C. (2001). On the functional origins of essentialism. *Mind & Society*, 2(1), 1-30.
- Barrett, H. C. (2004). Design versus descent in Shuar children's reasoning about animals. *Journal of Cognition and Culture*, 4(1), 25-50.
- Barrett, H. C. (2005). Adaptations to predators and prey. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 200-223). New Jersey: John Wiley & Sons.
- Barrett, J. L. (2010). The relative unnaturalness of atheism: On why Geertz and Markusson are both right and wrong. *Religion*, 40(3), 169-172.
- Barrett, J. L., & Keil, F. C. (1996). Conceptualizing a nonnatural entity: Anthropomorphism in God concepts. *Cognitive Psychology*, 31(3), 219-247.
- Barrett, J. L., & Lanman, J. A. (2008). The science of religious beliefs. *Religion*, 38(2), 109-124.
- Bateson, M., Nettle, D., & Roberts, G. (2006). Cues of being watched enhance cooperation in a real-world setting. *Biology Letters*, 2(3), 412-414.
- Bean, T. E., Sinatra, G. M., & Schrader, P. G. (2010). Spore: Spawning Evolutionary Misconceptions? *Journal of Science Education and Technology*, 19(5), 409-414.
- Behe, M. J. (1996). *Darwin's black box. The biochemical challenge to evolution*. New York: Free Press.
- Behe, M. J. (1997). *Intelligent design. De zwarte doos van Darwin (met een voorwoord van Arie van den Beukel)* (H. Moerdijk, Trans.). Baarn: Ten Have.
- Behe, M. J. (2001). Molecular machines. Experimental support for the design inference. In R. T. Pennock (Ed.), *Intelligent Design Creationism and its critics. Philosophical, theological and scientific perspectives* (pp. 241-256). Cambridge: MIT Press.
- Behe, M. J. (2006). *Darwin's black box. The biochemical challenges to evolution. Tenth anniversary edition*. New York, New York: Free Press.
- Behe, M. J. (2007). *The edge of evolution. The search for the limits of Darwinism*. New York: Free press.
- Benassi, V. A., Singer, B., & Reynolds, C. B. (1980). Occult belief - seeing is believing. *Journal for the Scientific Study of Religion*, 19(4), 337-349.
- Bering, J. (2010). Atheism is only skin deep: Geertz and Markusson rely mistakenly on sociodemographic data as meaningful indicators of underlying cognition. *Religion*, 40(3), 166-168.
- Berti, A. E., Toneatti, L., & Rosati, V. (2010). Children's Conceptions About the Origin of Species: A Study of Italian Children's Conceptions With and Without Instruction. *Journal of the Learning Sciences*, 19(4), 506-538.
- Bishop, B. A., & Anderson, C. W. (1990). Student conceptions of natural selection and its role in evolution. *Journal of Research in Science Teaching*, 27(5), 415-427.
- Blancke, S. (2004). Wetenschap naar antroposofisch geloven: de mens dan toch het doel van de evolutie? De evolutie volgens Jos Verhulst. *Wonder en is gheen wonder. Tijdschrift voor wetenschap en rede*, 3, 29-32.
- Blancke, S. (2009a). Dutch, Belgian creationist groups unite to bring anti-evolution message to six million. *Skeptical Inquirer*, 33(1), 7.
- Blancke, S. (2009b). *Evoluтиetheorie*. Antwerpen: Luster.
- Blancke, S. (2009c). Exporting creationism: Dutch creationist leaflet now to be distributed in Belgium. *Reports of the National Center for Science Education*, 29(5), 7-9.

- Blancke, S. (2009d). Waarom Intelligent Design geen wetenschappelijk alternatief is voor de evolutietheorie (Why Intelligent Design is not a scientifically sound alternative to evolutionary theory).
- Blancke, S. (2009e). Waarom is de muizenval-analogie van Michael Behe misleidend en wetenschappelijk niet overtuigend? (Why is the mousetrap analogy by M. Behe deceiving and scientifically unsound?), from <http://evolutietheorie.be/>
- Blancke, S. (2010). Creationism in the Netherlands. *Zygon. Journal of Religion and Science*, 45(4), 791-816.
- Blancke, S. (submitted). Catholic responses to evolutionary theory, 1859-2009: local influence and mid-scale patterns. *Journal of Religious History*.
- Blancke, S., Boudry, M., & Braeckman, J. (2011). Simulation of biological evolution under attack, but not really: a response to Meester. *Biology and Philosophy*, 26(1), 113-118.
- Blancke, S., Boudry, M., Braeckman, J., Smedt, J. D., & Cruz, H. D. (in press). Dealing with creationist challenges. What European biology teachers might expect in the classroom. *Journal of Biological Education*.
- Blancke, S., & De Smedt, J. (forthcoming). Evolved to be irrational? Evolutionary and cognitive foundations of pseudosciences. In M. Pigliucci & M. Boudry (Eds.), *The philosophy of pseudosciences*. Chicago: The University of Chicago Press.
- Blancke, S., De Smedt, J., De Cruz, H., Boudry, M., & Braeckman, J. (in press). The implications of the cognitive sciences for the relation between religion and science education: the case of evolutionary theory. *Science & Education*.
- Blancke, S., Flipse, A. C., & Braeckman, J. (forthcoming). Creationism in the Low Countries. In S. Blancke, H. H. Hjerimitslev & P. C. Kjærgaard (Eds.), *The history of creationism in Europe*. Baltimore: The Johns Hopkins University Press.
- Blancke, S., Hjerimitslev, H. H., Braeckman, J., & Kjærgaard, P. C. (submitted). Creationism in Europe: facts, gaps and prospects. *Religion*.
- Bloom, P. (2004). *Descartes' baby. How child development explains what makes us human*. London: Arrow Books.
- Bogaerts, A. (2005). *De ontkenning van de evolutietheorie door de Islam*. Lessius Hogeschool, Antwerpen.
- Borczyk, B. (2010). Creationism and the Teaching of Evolution in Poland. *Evolution: Education and Outreach*, 3(4), 614-620.
- Boudry, M., Blancke, S., & Braeckman, J. (2010a). How Not to Attack Intelligent Design Creationism: Philosophical Misconceptions About Methodological Naturalism. *Foundations of Science*, 15(3), 227-244.
- Boudry, M., Blancke, S., & Braeckman, J. (2010b). Irreducible Incoherence - a look into the conceptual toolbox of a pseudoscience. *Quarterly Review of Biology*, 85(4), 473-482.
- Bowler, P. J. (1992). *The eclipse of Darwinism. Anti-Darwinian evolution theories in the decades around 1900*. Baltimore: Johns Hopkins Press.
- Bowler, P. J. (2007). *Monkey trials and gorilla sermons. Evolution and Christianity from Darwin to intelligent design*. Cambridge: Harvard University Press.
- Boyer, P. (2001). *Religion explained. The evolutionary origins of religious thought*. New York: Basic books.
- Boyer, P., & Barrett, H. C. (2005). Domain specificity and intuitive ontology. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 96-118). Hoboken: John Wiley & Sons.
- Braeckman, J. (1997). God als almachtige horlogemaker. Over Bernard Nieuwentyts natuurtheologie. *Tijdschrift voor Ecologische Geschiedenis*, 2(1), 11-17.
- Braeckman, J. (2008). *Darwins moordbekentenis : de ontwikkeling van het denken van Charles darwin* (2de opl. ed.). Amsterdam: Nieuwezijds.

- British Council (2009). *Darwin international survey*.
- Brooke, J. H. (1991). *Science and religion : some historical perspectives*. Cambridge: Cambridge University Press.
- Brummer, C. (2010). Popular "scientific" magazine distributed by young earth creationists in the Netherlands. *Reports of the National Center for Science Education*, 30(5), 6-7.
- Brundell, B. (2001). Catholic Church politics and evolution theory, 1894-1902. *The British Journal for the History of Science*, 34(01), 81-95.
- Bryan, W. J. (2007). Summary argument in Scopes trial. In C. C. Young & M. A. Largent (Eds.), *Evolution and creationism. A documentary and reference guide* (pp. 155-170). Westport, Connecticut: Greenwood Press.
- Buell, J., & Hearn, V. (Eds.). (1994). *Darwinism: science or philosophy? Proceedings of a symposium entitled: "Darwinism: scientific inference or philosophical preference?"*. Richardson: Foundation for Thoughts and Ethics.
- Buitenwerf-van der Molen, M. (2011). God als motor van de vooruitgang. De evolutietheologie van de modernen in de tweede helft van de negentiende eeuw in Nederland. In A. C. Flipse & G. Harinck (Eds.), *Waar komen we vandaan? Anderhalve eeuw evolutiedebat in protestants-christelijk Nederland* (pp. 9-15). Amsterdam: Historisch Documentatiecentrum voor het Nederlands Protestantisme (1800-heden).
- Bulhof, I. N. (1988). The Netherlands. In T. F. Glick (Ed.), *The comparative reception of Darwinism* (pp. 269-306). Chicago: University of Chicago Press.
- Buss, D. M. (2008). *Evolutionary psychology. The new science of the mind* (Third ed.). Boston: Pearson.
- Byrne, R. W. (1996). Machiavellian intelligence. *Evolutionary Anthropology: Issues, News, and Reviews*, 5(5), 172-180.
- Carey, S., & Spelke, E. (1994). Domain-specific knowledge and conceptual change. In L. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind. Domain specificity in cognition and culture*. Cambridge: Cambridge University Press.
- Casler, K., & Kelemen, D. (2008). Developmental continuity in teleo-functional explanation: Reasoning about nature among Romanian Romani adults. *Journal of Cognition and Development*, 9(3), 340-362.
- Centraal Bureau voor de Statistiek (2008). *Statistisch Jaarboek 2008*. Den Haag Centraal Bureau voor de Statistiek.
- Chaigneau, S. E., Castillo, R. D., & Martínez, L. (2008). Creators' intentions bias judgments of function independently from causal inferences. *Cognition*, 109(1), 123-132.
- Chi, M. T. H. (2005). Commonsense conceptions of emergent processes: Why some misconceptions are robust. *Journal of the Learning Sciences*, 14(2), 161-199.
- Chinn, C. A., & Buckland, L. A. (2011). Differences in epistemic practices among scientists, Young Earth creationists, Intelligent Design creationists, and the scientist-creationists of Darwin's era. In R. S. Taylor & M. Ferrari (Eds.), *Epistemology and science education. Understanding the evolution vs. Intelligent Design controversy* (pp. 38-76). New York: Routledge.
- Cleaves, A., & Toplis, R. (2007). In the shadow of Intelligent Design: the teaching of evolution. *Journal of biological education*, 42(1), 30-35.
- Clément, P., & Quessada, M.-P. (2009). Creationist Beliefs in Europe. *Science*, 324(5935), 1644-1644.
- Clément, P., Quessada, M.-P., Laurent, C., & Carvalho, G. (2008). *Science and religion: evolutionism and creationism in education. A survey of teachers conceptions in 14 countries*. Paper presented at the XIII IOSTE Symposium. The use of science and technology education for peace and sustainable development.

- Coleman, S., & Carlin, L. (1996). No contest: the non-debate between creationism and evolutionary theory in Britain. *Creation/Evolution*, 16(1), 1-9.
- Coleman, S., & Carlin, L. (2004). Introduction. In S. Coleman & L. Carlin (Eds.), *The cultures of creationism. Anti-evolutionism in English-speaking countries* (pp. 1-28). Aldershot: Ashgate.
- Collins, F. S. (2006). *De taal van God*. Baarn: Ten Have.
- Committee on Culture, S. a. E. P. A. C. o. E. (2007). *Doc. 11297. The dangers of creationism in education*.
- Cornish-Bowden, A., & Càrdenas, M. L. (2007). The threat from creationism to the rational teaching of biology. *Biological Research*, 40(2), 113-122.
- Corsi, P., & Weindling, P. J. (1985). Darwinism in Germany, France, and Italy. In D. Kohn (Ed.), *The Darwinian heritage* (pp. 683-729). New Jersey: Princeton University Press.
- Coyne, J. A. (2009). *Why evolution is true*. New York: Viking.
- Cunningham, D. L., & Wescott, D. J. (2009). Still more "fancy" and "myth" than "fact" in students' conceptions of evolution. *Evolution: Education and Outreach*, 2(3), 505-517.
- Currat, M., Excoffier, L., Maddison, W., Otto, S. P., Ray, N., Whitlock, M. C., et al. (2006). Comment on "Ongoing adaptive evolution of ASPM, a brain size determinant in homo sapiens" and "microcephalin, a gene regulating brain size, continues to evolve adaptively in humans". *Science*, 313(5784).
- Curry, A. (2009). Creationist Beliefs Persist in Europe. *Science*, 323(5918), 1159-1159.
- Darwin, C. (1859). *On the origin of species by means of natural selection : or the preservation of favoured races in the struggle for life*. London: John Murray.
- Darwin, C. (1871). *The descent of man, and selection in relation to sex*. London: John Murray.
- Davis, P., Kenyon, D. H., & Thaxton, C. B. (1993). *Of pandas and people. The central question of biological origins*. Dallas: Houghton Publishing Company.
- Dawkins, R. (1986). *The blind watchmaker*. Harlow: Longman Scientific & Technical.
- Dawkins, R. (2006 [1986]). *The blind watchmaker*. London, UK: Penguin Books.
- Dawkins, R. (2009). *The greatest show on Earth : the evidence for evolution*. London: Bantam.
- De Bont, R. (2005). Rome and theistic evolutionism: The hidden strategies behind the 'Dorlodot affair', 1920-1926. *Annals of Science*, 62(4), 457-478.
- De Bont, R. (2008a). *Darwins kleinkinderen : de evolutietheorie in België 1865-1945*. Nijmegen: Vantilt.
- De Bont, R. (2008b). 'Foggy and contradictory': evolutionary theory in Belgium, 1859-1945. In E.-M. Engels & T. F. Glick (Eds.), *The reception of Charles Darwin in Europe* (Vol. I, pp. 188-198). London: Continuum.
- De Cruz, H. (2009). The role of intuitive probability in scientific theory formation. In B. Lowe, E. Pacuit & J.-W. Romeijn (Eds.), *Foundations of the formal sciences VI. Probabilistic reasoning and reasoning with probabilities* (pp. 123-139). London: College Publications.
- De Cruz, H., & De Smedt, J. (2007). The role of intuitive ontologies in scientific understanding - the case of human evolution. *Biology and Philosophy*, 22(3), 351-368.
- De Cruz, H., & De Smedt, J. (2010). Paley's iPod. The cognitive basis of the design argument within natural theology. *Zygon. Journal of Religion and Science*, 45(3), 665-684.
- De Cruz, H., & De Smedt, J. (in press). Evolved cognitive biases and the epistemic status of scientific beliefs. *Philosophical Studies*.
- Dekker, C. (2005). De terugkeer van ontwerp in de wetenschap (The return of design in science). In C. Dekker, R. Meester & R. Van Woudenberg (Eds.), *Schitterend ongeluk of sporen van ontwerp? Over toeval en doelgerichtheid in de evolutie* (pp. 42-62). Kampen: Ten Have.

- Dekker, C. (2006). Schiep God de mens of schiep de mens God? (Did God create man, or did man create God?). In C. Dekker, R. Meester & R. Van Woudenberg (Eds.), *En God beschikte een worm. Over schepping en evolutie* (pp. 360-383). Kampen: Ten Have.
- Dekker, C. (2007). Naar een *Brave New World?* (Towards a *Brave New World?*). In C. Dekker, R. Van Woudenberg & G. Van den Brink (Eds.), *Omhoog kijken in Platland. Over geloven in de wetenschap* (pp. 279-303). Kampen: Ten Have.
- Dekker, C. (2008a). Uit wat ik ben en was (From what I am and what I was). In C. Dekker (Ed.), *Geleerd en gelovig. 22 wetenschappers over hun leven, werk en God* (pp. 317-327). Baarn: Ten Have.
- Dekker, C. (Ed.). (2008b). *Geleerd en gelovig. 22 wetenschappers over hun leven, werk en God* (*Learned and religious. 22 scientists on their life, work, and God*). Baarn: Ten Have.
- Dekker, C., & Meester, R. (2002). Pleidooi voor een open houding ten aanzien van de historische oorsprong van het leven (A plea for an open attitude towards the historical origin of life). *Skepter*, 15(4), 42-45.
- Dekker, C., Meester, R., & Van Woudenberg, R. (Eds.). (2005). *Schitterend ongeluk of sporen van ontwerp? Over toeval en doelgerichtheid in de evolutie* (*Glorious accident or traces of design? On chance and purposiveness in evolution*). Baarn: Ten Have.
- Dekker, C., Meester, R., & Van Woudenberg, R. (Eds.). (2006). *En God beschikte een worm. Over schepping en evolutie* (*And God prepared a worm. On creation and evolution*). Kampen: Ten Have.
- Dekker, C., Van Woudenberg, R., & Van den Brink, G. (Eds.). (2007). *Omhoog kijken in Platland. Over geloven in de wetenschap* (*Looking up in Flatland. On faith in science*). Kampen: Ten Have.
- Dembski, W. A. (1998). *The design inference. Eliminating chance through small probabilities*. Cambridge: Cambridge University Press.
- Dembski, W. A. (1999). *Intelligent design. The bridge between science and theology*. Downers Grove: InterVarsity Press.
- Dembski, W. A. (2002). *No free lunch. Why specified complexity cannot be purchased without intelligence*. Lanham: Rowman & Littlefield.
- Dembski, W. A. (2004). *The design revolution. Answering the toughest questions about Intelligent Design*. Downers Grove: Intervarsity Press.
- Dembski, W. A., & Wells, J. (2008). *The design of life. Discovering signs of intelligence in biological systems*. Dallas: Foundation for Thought and Ethics.
- Dennett, D. C. (1987). *The intentional stance*. Cambridge: MIT Press.
- Dennett, D. C. (1995). *Darwin's dangerous idea*. London: Penguin.
- Dennett, D. C., & LaScola, L. (2010). Preachers Who Are Not Believers. *Evolutionary Psychology*, 8(1), 122-150.
- Denton, M. (1985). *Evolution. A theory in crisis*. London: Burnett.
- Diesendruck, G., & Haber, L. (2009). God's categories: The effect of religiosity on children's teleological and essentialist beliefs about categories. *Cognition*, 110(1), 100-114.
- Diesendruck, G., Markson, L., & Bloom, P. (2003). Children's reliance on creator's intent in extending names for artifacts. *Psychological Science*, 14(2), 164-168.
- Discovery Institute (1999). The Wedge. Center for the Renewal of Science and Culture Retrieved 21 January, 2009, from <http://www.antievolution.org/features/wedge.pdf>
- Discovery Institute (2005). Truth sheet # 05-01 Discovery Institute and 'theocracy' Retrieved 17 November, 2008, from <http://www.discovery.org/scripts/viewDB/filesDB-download.php?command=download&id=463>
- Dixon, T., Cantor, G., & Pumfrey, S. (Eds.). (2010). *Science and religion. New historical perspectives*. Cambridge: Cambridge University Press.
- Edis, T. (1994). Islamic creationism in Turkey. *Creation/Evolution*, 14(1), 1-12.

- Edis, T. (1999). Cloning creationism in Turkey. *Reports of the National Center for Science Education*, 19(6), 30-35.
- Edis, T. (2004). Chance and necessity - and intelligent design? In M. Young & T. Edis (Eds.), *Why Intelligent Design fails. A scientific critique of the new creationism* (pp. 139-152). New Brunswick: Rutgers University Press.
- Edis, T. (2007). *An illusion of harmony. Science and religion in Islam*. Amherst: Prometheus Books.
- Edis, T. (2008). *Science and nonbelief*. New York: Prometheus.
- Enserink, M. (2005). Evolution politics: Is Holland becoming the Kansas of Europe? *Science*, 308, 1394.
- Ernest-Jones, M., Nettle, D., & Bateson, M. (2011). Effects of eye images on everyday cooperative behavior: a field experiment. *Evolution and Human Behavior*, 32(3), 172-178.
- European Commission (2005). *Special Eurobarometer. Europeans, Science and Technology*.
- Evans, E. M. (2000a). Beyond Scopes. Why creationism is here to stay. In K. Rosengren, C. Johnson & P. Harris (Eds.), *Imagining the impossible: Magical, scientific and religious thinking in children* (pp. 305-331). Cambridge: Cambridge University Press.
- Evans, E. M. (2000b). The emergence of beliefs about the origins of species in school-age children. *Merrill-Palmer Quarterly-Journal of Developmental Psychology*, 46(2), 221-254.
- Evans, E. M. (2001). Cognitive and contextual factors in the emergence of diverse belief systems: Creation versus evolution. *Cognitive Psychology*, 42(3), 217-266.
- Evans, E. M. (2008). Conceptual change and evolutionary biology: a developmental analysis. In S. Vosniadou (Ed.), *International handbook of research of conceptual change* (pp. 263-294). New York: Routledge.
- Evans, E. M., & Lane, J. D. (2011). Contradictory or Complementary? Creationist and Evolutionist Explanations of the Origin(s) of Species. *Human Development*, 54(3), 144-159.
- Evans, E. M., Legare, C. H., & Rosengren, K. S. (2011). Engaging multiple epistemologies. Implications for science education. In R. S. Taylor & M. Ferrari (Eds.), *Epistemology and science education*. New York: Routledge.
- Evans, J. S. B. T. (2010). *Thinking twice. Two minds in one brain*. Oxford: Oxford University Press.
- Evans, P. D., Gilbert, S. L., Mekel-Bobrov, N., Vallender, E. J., Anderson, J. R., Vaez-Azizi, L. M., et al. (2005). Microcephalin, a gene regulating brain size, continues to evolve adaptively in humans. *Science*, 309(5741), 1717-1720.
- Eve, R. A., & Harrold, F. B. (1991). *The creationist movement in modern America*. Boston: Twayne.
- Fail, J. (2008). A No-Holds-Barred Evolution Curriculum for Elementary and Junior High School Students. *Evolution: Education and outreach*, 1(1), 56-64.
- Fairbanks, D. J. (2007). *Relics of Eden. The powerful evidence of evolution in human DNA*. New York: Prometheus.
- Flipse, A. C. (2008). *Between neo-Thomist natural philosophy and secular science: Roman Catholic scientists in the Netherlands, 1900-1950*. Paper presented at the Third ICESHS.
- Flipse, A. C. (2011). Amerikaanse geleerden van formaat die deze dingen heel anders zien. Nederlands gereformeerden en het creationisme. In A. C. Flipse & G. Harinck (Eds.), *Waar komen we vandaan? Anderhalve eeuw evolutiedebat in protestants-christelijk Nederland* (pp. 31-39). Amsterdam: Historisch Documentatiecentrum voor het Nederlands Protestantisme.
- Flipse, A. C. (2012). The Origins of Creationism in the Netherlands: The Evolution Debate among Twentieth-Century Dutch Neo-Calvinists. *Church History. Studies in christianity and culture*, 81(1).

- Flipse, A. C. (in press-a). "De schepping zou er even wonderbaar om zijn." Geschiedenis van het evolutiedebat in gereformeerde en rooms-katholieke kring ("The creation would just be as marvelous." The history of the evolution debate in reformed and Roman Catholic circles). In K. Van Bekkum & G. Harinck (Eds.), *Botsen over het begin. Bavinck lezingen 2009*.
- Flipse, A. C. (in press-b). The Origins of Creationism in the Netherlands: The Evolution Debate among Twentieth-Century Dutch Neo-Calvinists. *Church History. Studies in christianity and culture*.
- Forrest, B. (2007). *Understanding the Intelligent Design movement: its true nature and goals. A position paper from the Center for Inquiry office of public policy*. Washington D.C.: Center for Inquiry.
- Forrest, B., & Gross, P. R. (2005). The Wedge of Intelligent Design. Retrograde science, schooling and society. In N. Koertge (Ed.), *Scientific values and civic virtue* (pp. 191-214). New York: Oxford University Press.
- Forrest, B., & Gross, P. R. (2007[2004]). *Creationism's Trojan horse. The wedge of Intelligent Design* (Second ed.). New York: Oxford University Press.
- Fulljames, P., & Francis, L. (2004). Creationism among young people in Kenya and Britain. In S. Coleman & L. Carlin (Eds.), *The cultures of creationism. Anti-evolutionism in English-speaking countries* (pp. 165-173). Aldershot: Ashgate.
- Geertz, A. W., & Markússon, G. I. (2010). Religion is natural, atheism is not: On why everybody is both right and wrong. *Religion*, 40(3), 152-165.
- Gelman, S. A. (2003). *The essential child. Origins of essentialism in everyday thought*. Oxford: Oxford University Press.
- Gelman, S. A. (2004). Psychological essentialism in children. *Trends in Cognitive Sciences*, 8(9), 404-409.
- Gelman, S. A., Coley, J. D., & Gottfried, G. M. (1994). Essentialist beliefs in children: the acquisition of concepts and theories. In L. A. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind. Domain specificity in cognition and culture* (pp. 341-365). Cambridge: Cambridge University Press.
- Gelman, S. A., & Wellman, H. M. (1991). Insides and essences. Early understandings of the non-obvious. *Cognition*, 38(3), 213-244.
- Gergely, G., Knadasdy, Z., Csibra, G., & Biro, S. (1995). Taking the intentional stance at 12 months of age. *Cognition*, 56(2), 165-193.
- Gigerenzer, G. (2008). *Rationality for mortals. How people cope with uncertainty*. Oxford: Oxford University Press.
- Gigerenzer, G., & Edwards, A. (2003). Simple tools for understanding risks: from innumeracy to insight. *British Medical Journal*, 327(7417), 741-744.
- Gigerenzer, G., Todd, P. M., & the ABC research group (1999). *Simple heuristics that make us smart*. Oxford: Oxford University Press.
- Gilovich, T., Griffin, D., & Kahneman, D. (Eds.). (2002). *Heuristics and biases. The psychology of intuitive judgment*. Cambridge: Cambridge University Press.
- Gish, D. T. (1978). *Evolution? The fossils say NO! Third edition*. San Diego: Creation-Life Publishers.
- Gishlick, A. D. (2004). Evolutionary paths to irreducible systems. The avian flight apparatus. In M. Young & T. Edis (Eds.), *Why Intelligent Design fails. A scientific critique of the new creationism* (pp. 58-71). New Brunswick: Rutgers University Press.
- Glick, T. F. (1988). Spain. In T. F. Glick (Ed.), *The comparative reception of Darwinism* (pp. 307-345). Chicago: University of Chicago Press.

- Glick, T. F. (2001). The reception of Darwinism in Uruguay. In T. F. Glick, M. A. Puig-Samper & R. Ruiz (Eds.), *The reception of Darwinism in the Iberian world. Spain, Spanish America and Brazil* (pp. 29-52). Dordrecht: Kluwer Academic Publishers.
- Godfrey-Smith, P. (1991). Signal, decision, action. *Journal of Philosophy*, 88(12), 709-722.
- González Galli, L., & Meinardi, E. (2011). The Role of Teleological Thinking in Learning the Darwinian Model of Evolution. *Evolution: Education and Outreach*, 4(1), 145-152.
- Gould, S. J. (1997). Nonoverlapping magisteria. *Natural History*, 106(2), 16-22.
- Graebisch, A. (2006). Polish scientists fight creationism. *Nature*, 443, 890-891.
- Graebisch, A., & Schiermeier, Quirin (2006). Anti-evolutionists raise their profile in Europe. *Nature*, 444(7121), 803-803.
- Gregory, T. R. (2009). Understanding natural selection: Essential concepts and common misconceptions. *Evolution: Education and Outreach*, 2(2), 156-175.
- Gross, M. (2002). US-style creationism spreads to Europe. [News Item]. *Current Biology*, 12(8), R265-R266.
- Guthrie, S. (1993). *Faces in the clouds. A new theory of religion*. New York: Oxford University Press.
- Häggström, O. (2007a). Intelligent design and the NFL theorems. *Biology and Philosophy*, 22(2), 217-230.
- Häggström, O. (2007b). Uniform distribution is a model assumption Retrieved 3 October, 2009, from http://www.cs.chalmers.se/~olleh/reply_to_Dembski.pdf
- Haley, K. J., & Fessler, D. M. T. (2005). Nobody's watching?: Subtle cues affect generosity in an anonymous economic game. *Evolution and Human Behavior*, 26(3), 245-256.
- Hameed, S. (2008). Science and religion Bracing for Islamic Creationism. *Science*, 322(5908), 1637-1638.
- Hameed, S. (2010). Evolution and creationism in the Islamic world. In T. Dixon, G. Cantor & S. Pumfrey (Eds.), *Science and religion. New historical perspectives* (pp. 133-152). Cambridge: Cambridge University Press.
- Harrison, B. W. (2001). Early Vatican responses to evolutionist theology. *Living tradition. Organ of the Roman theological forum*, (93). Retrieved from <http://www.rtforum.org/lt/lt93.html>
- Haselton, M. G., Nettle, D., & Andrews, P. W. (2005). The evolution of cognitive bias. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 724-746). New Jersey: John Wiley & Sons.
- Hassan, R. (2007). On being religious: Patterns of religious commitment in Muslim societies. [Article]. *Muslim World*, 97(3), 437-478.
- Haught, J. F. (2000). *God after Darwin : a theology of evolution*. Boulder (Colo.): Westview press.
- Henrich, J., & Gil-White, F. J. (2001). The evolution of prestige - Freely conferred deference as a mechanism for enhancing the benefits of cultural transmission. *Evolution and Human Behavior*, 22(3), 165-196.
- Hertwig, R., & Gigerenzer, G. (1999). The 'conjunction fallacy' revisited: How intelligent inferences look like reasoning errors. *Journal of Behavioral Decision Making*, 12(4), 275-305.
- Hilton, D. (2002). Thinking about causality: pragmatic, social and scientific rationality. In P. Carruthers, S. P. Stich & M. Siegal (Eds.), *The cognitive basis of science* (pp. 211-231). Cambridge: Cambridge University Press.
- Hjermitslev, H. H. (2010a). Danske Kreationisme. *Religion*(1), 17-27.
- Hjermitslev, H. H. (2010b). *Marginalized and Moderate: The Current Status of Creationism in Denmark and the History of why Antievolutionism Has Never Gained Ground among Mainline Danish Protestants*. Paper presented at the Religion in global perspective. Society for the Scientific Study of Religion Annual Meeting.

- Hjermitslev, H. H. (2011). Protestant Responses to Darwinism in Denmark, 1859-1914. *Journal of the History of Ideas*, 72(2), 279-303.
- Hofman, H. A. (2009). *Het bittere conflict. Over schepping en evolutie in het jaar van Darwin en Calvijn*. Soesterberg: Uitgeverij ASPEKT.
- Hokayem, H., & BouJaoude, S. (2008). College students' perceptions of the theory of evolution. *Journal of Research in Science Teaching*, 45(4), 395-419.
- Hood, B. M. (2008). *Supersense. Why we believe in the unbelievable*. San Francisco: HarperOne.
- Hu, D. Y., Hou, L. H., Zhang, L. J., & Xu, X. (2009). A pre-Archaeopteryx troodontid theropod from China with long feathers on the metatarsus. *Nature*, 461(7264), 640-643.
- Hull, D. L. (2009). Darwin's science and Victorian philosophy of science. In J. Hodge & G. Radick (Eds.), *The Cambridge Companion to Darwin. Second edition*. (pp. 173-196). Cambridge, UK: Cambridge University Press.
- Hulspas, M. (2002). Twee geloven op een kussen. De schepping als intelligent ontwerp (Two faiths sleeping on a cushion. Creation as intelligent design). *Skepter*, 15(1).
- Humphrey, N. K. (1976). The social function of intellect. In P. P. G. Bateson & R. A. Hinde (Eds.), *Growing points in ethology* (pp. 303-317). Cambridge: Cambridge University Press.
- Ipsos Global @dvisory (2011). *Supreme being(s), the afterlife and evolution*.
- Jacobson, M. J., & Wilensky, U. (2006). Complex systems in education: Scientific and educational importance and implications for the learning sciences. *Journal of the Learning Sciences*, 15(1), 11-34.
- John Paul II (1996). Truth cannot contradict truth. Address of Pope John Paul II to the Pontifical Academy of Sciences (October 22, 1996) Retrieved from http://www.newadvent.org/library/docs_jp02tc.htm
- Johnson, P. E. (1991). *Darwin on trial*. Downers Grove: Intervarsity Press.
- Johnson, P. E. (1995). *Reason in the balance. The case against naturalism in science, law and education*. Downers Grove: InterVarsity.
- Johnson, P. E. (1996a). Is God unconstitutional? The established religious philosophy of America, part 1 Retrieved 21 January, 2009, from <http://www.leaderu.com/real/ri9403/johnson.html>
- Johnson, P. E. (1996b). Is God unconstitutional? The established religious philosophy of America, part 2 Retrieved 21 January, 2009, from <http://www.leaderu.com/real/ri9404/johnson2.html>
- Johnson, P. E. (1997a). *Defeating Darwinism by opening minds*. Downers Grove: Intervarsity Press.
- Johnson, P. E. (1997b). Nihilism and the end of law. *First Things*, 77(November 1997), 22-25.
- Johnson, P. E. (2001). Evolution as dogma. The establishment of naturalism. In R. T. Pennock (Ed.), *Intelligent Design creationism and its critics. Philosophical, theological and scientific perspectives* (pp. 59-76). Cambridge: MIT Press.
- Kapusta, P. (2009). Darwinism from *Humani Generis* to the present. In L. Caruana (Ed.), *Darwin and Catholicism. The past and present dynamics of a cultural encounter* (pp. 27-42). London: T&T Clark.
- Keil, F. C. (1989). *Concepts, kinds and cognitive development*. Cambridge: MIT Press.
- Kelemen, D. (1999a). The scope of teleological thinking in preschool children. *Cognition*, 70(3), 241-272.
- Kelemen, D. (1999b). Why are rocks pointy? Children's preference for teleological explanations of the natural world. *Developmental Psychology*, 35(6), 1440-1452.
- Kelemen, D. (2003). British and American children's preferences for teleo-functional explanations of the natural world. *Cognition*, 88(2), 201-221.

- Kelemen, D. (2004). Are children "intuitive theists"? Reasoning about purpose and design in nature. *Psychological Science*, 15(5), 295-301.
- Kelemen, D. (in press). Teleological minds. How natural intuitions about agency and purpose influence learning about evolution. In K. S. Rosengren & E. M. Evans (Eds.), *Evolution challenges: integrating research and practice in teaching and learning about evolutionary theory*. Oxford: Oxford University Press.
- Kelemen, D., Callanan, M. A., Casler, K., & Perez-Granados, D. R. (2005). Why things happen: Teleological explanation in parent-child conversations. *Developmental Psychology*, 41(1), 251-264.
- Kelemen, D., & Di Yanni, C. (2005). Intuitions about origins: purpose and intelligent design in children's reasoning about nature. *Journal of Cognition and Development*, 6(1), 3-31.
- Kelemen, D., & Rosset, E. (2009). The human function compunction: Teleological explanation in adults. *Cognition*, 111(1), 138-143.
- Kelemen, D., Widdowson, D., Posner, T., Brown, A. L., & Casler, K. (2003). Teleo-functional constraints on preschool children's reasoning about living things. *Developmental Science*, 6(3), 329-345.
- Kitcher, P. (2008). Science, religion and democracy. *Episteme*, 5(1), 5-18.
- Kjærgaard, P. C. (2008). Western front. *New Humanist*, 123(3), 39-41.
- Kjærgaard, P. C. (2010). The Darwin enterprise: from scientific icon to global product. *History of Science*, 48(159), 105-122.
- Knevel, A. (2007). *Avonduren. Dagboek van een bewogen jaar (Evening hours. Diary of an eventful year)*. Baarn: Ten Have.
- Knight, N., Sousa, P., Barrett, J. L., & Atran, S. (2004). Children's attributions of beliefs to humans and God: cross-cultural evidence. *Cognitive Science*, 28(1), 117-126.
- Kuhlmeier, V. A., Bloom, P., & Wynn, K. (2004). Do 5-month-old infants see humans as material objects? *Cognition*, 94(1), 95-103.
- Kutschera, U. (2003). Darwinism and Intelligent Design: the new anti-evolutionism spreads in Europe. *Reports of the National Center for Science Education*, 23(5-6), 5-6.
- Kutschera, U. (2006). Devolution and dinosaurs: the anti-evolution seminar in the European Parliament. *Reports of the National Center for Science Education*, 26(5), 10-11.
- Kutschera, U. (2007a). *Streitpunkt Evolution. Darwinismus und Intelligentes Design* (2nd ed.). Berlin: LIT.
- Kutschera, U. (2008a). Creationism in Germany and its possible cause. *Evolution. Education and outreach*, 1(84-86).
- Kutschera, U. (2008b). The German anti-Darwin industry: Twentieth anniversary of a multi-media business. *Reports of the National Center for Science Education*, 28(1), 12-13.
- Kutschera, U. (Ed.). (2007b). *Kreationismus in Deutschland. Fakten und Analysen*. Berlin: LIT.
- Lane, J. D., Wellman, H. M., & Evans, E. M. (2010). Children's Understanding of Ordinary and Extraordinary Minds. *Child Development*, 81(5), 1475-1489.
- Larson, E. J. (1997). *Summer for the gods : the Scopes trial and America's continuing debate over science and religion*. New York: Basic Books.
- Larson, E. J. (2003). *Trial and error. The American controversy over creation and evolution*. New York: Oxford University Press.
- Larson, E. J. (2006). *Summer of the gods. The Scopes trial and America's continuing debate over science and religion*. New York: Basic Books.
- Lawson, A. E., & Weser, J. (1990). The rejection of nonscientific beliefs about life - effects of instruction and reasoning skills. *Journal of Research in Science Teaching*, 27(6), 589-606.
- Lawson, A. E., & Worsnop, W. A. (1992). Learning about evolution and rejecting a belief in special creation - effects of reflective reasoning skill, prior knowledge, prior belief and religious commitment. *Journal of Research in Science Teaching*, 29(2), 143-166.

- Lawson, E. T. (2005). A new look at the science-and-religion dialogue. *Zygon*, 40(3), 555-563.
- Leeming, D. A., & Leeming, M. A. (1995). *A dictionary of creation myths*. New York: Oxford University Press.
- Leeuwenburgh, B. (2009). *Darwin in domineesland*. Nijmegen: Vantilt.
- Leeuwenburgh, B., & Van der Heide, J. (2008). Darwin on Dutch soil: the early reception of his ideas in the Netherlands. In E.-M. Engels & T. F. Glick (Eds.), *The reception of Charles Darwin in Europe* (Vol. I, pp. 175-187). London: Continuum.
- Lenski, R. E., Ofria, C., Pennock, R. T., & Adami, C. (2003). The evolutionary origin of complex features. *Nature*, 423(6936), 139-144.
- Lepeltier, T. (2007). *Darwin hérétique. L'éternel retour du créationnisme*. Paris: Seuil.
- Levit, G. S., Hoßfeld, U., & Olsson, L. (2006). Creationists attack secular education in Russia. *Nature*, 444, 265.
- Levit, I., Hoßfeld, U., & Olsson, L. (2007). Creationism in the Russian educational landscape. *RNCSE*, 27(5-6), 13-17.
- Linnen, C. R., Kingsley, E. P., Jensen, J. D., & Hoekstra, H. E. (2009). On the Origin and Spread of an Adaptive Allele in Deer Mice. *Science*, 325(5944), 1095-1098.
- Livingstone, D. N. (1987). *Darwin's forgotten defenders: the encounter between evangelical theology and evolutionary thought*. Grand Rapids, Mich.: W.B. Eerdmans.
- Livingstone, D. N. (1999). Science, region, and religion: the reception of Darwinism in Princeton, Belfast, and Edinburgh. In R. L. Numbers & J. Stenhouse (Eds.), *Disseminating Darwinism. The role of place, race, religion, and gender* (pp. 7-38). Cambridge: Cambridge University Press.
- Livingstone, D. N. (2009). Evolution and religion. In M. Ruse & J. Travis (Eds.), *Evolution. The first four billion years* (pp. 348-369). Cambridge, MA: Belknap Press of Harvard University Press.
- Locke, S. (2004). Creationist discourse and the management of political-legal discourse. In S. Coleman & L. Carlin (Eds.), *The cultures of creationism. Anti-evolutionism in English-speaking countries* (pp. 45-65). Aldershot: Ashgate.
- Lombrozo, T., Kelemen, D., & Zaitchik, D. (2007). Inferring design - Evidence of a preference for teleological explanations in patients with Alzheimer's disease. *Psychological Science*, 18(11), 999-1006.
- Lombrozo, T., Shtulman, A., & Weisberg, M. (2006). The Intelligent Design controversy: lessons from psychology and education. *Trends in Cognitive Sciences*, 10(2), 56-57.
- Lombrozo, T., Thanukos, A., & Weisberg, M. (2008). The importance of understanding the nature of science for accepting evolution. *Evolution: Education and Outreach*, 1(3), 290-298.
- Lyons, L. (2005). Paranormal beliefs come (super)naturally to some Retrieved 10th June, 2011, from <http://www.gallup.com/poll/19558/Paranormal-Beliefs-Come-SuperNaturally-Some.aspx>
- Mahner, M., & Bunge, M. (1996). Is religious education compatible with science education? *Science & Education*, 5(2), 101-123.
- Makris, N., & Pnevmatikos, D. (2007). Children's understanding of human and super-natural mind. *Cognitive Development*, 22(3), 365-375.
- Matzke, N. (2003). Evolution in (Brownian) space. A model for the origin of the bacterial flagellum Retrieved 3 January, 2009, from <http://www.talkdesign.org/faqs/flagellum.html>
- Matzke, N. (2010). The evolution of creationist movements. *Evolution: Education and Outreach*, 3(2), 145-162.
- Mayr, E. (1982). *The growth of biological thought. Diversity, evolution, and inheritance*. Cambridge: Harvard University Press.

- Mayr, E. (1991). *One long argument. Charles Darwin and the genesis of modern evolutionary thought*. London: Lane.
- McCauley, R. N. (2000). The naturalness of religion and the unnaturalness of science. In F. C. Keil & R. A. Wilson (Eds.), *Explanation and cognition* (pp. 61-86). Cambridge: MIT Press.
- McCrory, C., & Murphy, C. (2009). The Growing Visibility of Creationism in Northern Ireland: Are New Science Teachers Equipped to Deal with the Issues? *Evolution: Education and outreach*, 2(3), 372-385.
- McDonald, J. H. (2002). A reducible complex mousetrap, from <<http://udel.edu/~mcdonald/mousetrap.html>>
- McDonald, J. H. (n.d.). A reducibly complex mousetrap, from <http://udel.edu/~mcdonald/oldmousetrap.html>
- Medin, D. L., & Ortony, A. (1989). Psychological essentialism. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning* (pp. 179-195). Cambridge: Cambridge University Press.
- Meester, R. (2003). *Het pseudoniem van God. Een wiskundige over geloof, wetenschap en toeval (A pseudonym of God. A mathematician on religion, science and chance)*. Baarn: Ten Have.
- Meester, R. (2006). Mijn God, ik weet niet wie Gij zijt, maar wel dat Gij niet zijt een God naar mensentrant (My Lord, I don't know who Thou art, but I know that Thou art not a God after the image of man) In C. Dekker, R. Meester & R. Van Woudenberg (Eds.), *En God beschikte een worm. Over schepping en evolutie* (pp. 282-298). Kampen: Ten Have.
- Meester, R. (2009). Simulation of biological evolution and the NFL theorems. *Biology and Philosophy*, 24(4), 461-472.
- Mekel-Bobrov, N., Gilbert, S. L., Evans, P. D., Vallender, E. J., Anderson, J. R., Hudson, R. R., et al. (2005). Ongoing adaptive evolution of ASPM, a brain size determinant in Homo sapiens. *Science*, 309(5741), 1720-1722.
- Mercier, H., & Sperber, D. (2011). Why do humans reason? Arguments for an argumentative theory. *Behavioral and Brain Sciences*, 34(2), 57-+.
- Miller, J. D., Scott, E. C., & Okamoto, S. (2006). Public acceptance of evolution. [Editorial Material]. *Science*, 313(5788), 765-766.
- Miller, K. R. (1999). *Finding Darwin's God. A scientist's search for common ground between God and evolution*. New York: HarperCollins.
- Moore, D. W. (2005). Three in four Americans believe in paranormal Retrieved 10th June 2011, from <http://www.gallup.com/poll/16915/Three-Four-Americans-Believe-Paranormal.aspx>
- Moore, J. R. (1979). *The post-Darwinian controversies : a study of the Protestant struggle to come to terms with Darwin in Great Britain and America, 1870-1900*. Cambridge ; New York: Cambridge University Press.
- Morris, H. M. (1974a). *Scientific creationism (general edition)*. San Diego: Creation-Life Publishers.
- Morris, H. M. (1974b). *The troubled waters of evolution*. San Diego: Creation-Life Publishers.
- Morris, H. M. (1981). *Decade of creation*. San Diego: Creation-Life Publishers.
- Morris, H. M. (1984). *A history of modern creationism*. San Diego: Master Book.
- Musgrave, I. (2004). The evolution of the bacterial flagellum. In M. Young & T. Edis (Eds.), *Why Intelligent Design fails. A scientific critique of the new creationism* (pp. 72-84). New Brunswick: Rutgers University Press.
- Nehm, R. H., Kim, S. Y., & Sheppard, K. (2009). Academic preparation in biology and advocacy for teaching evolution. Biology versus non-biology teachers. *Science Education*, 93(6), 1122-1146.

- Nehm, R. H., & Schonfeld, I. S. (2007). Does increasing biology teacher knowledge of evolution and the nature of science lead to greater preference for the teaching of evolution in schools? *Journal of Science Teacher Education*, 18(5), 699-723.
- Nelson, C. E. (2007). Teaching evolution effectively: a central dilemma and alternative strategies. *McGill Journal of Education*, 42(2), 265-283.
- Nelson, C. E., Nickels, M. K., & Beard, J. (1998). The nature of science as foundation for teaching science: evolution as a case study. In W. F. McComas (Ed.), *The nature of science in science education. Rationales and strategies* (pp. 315-328). Dordrecht: Kluwer Academic Publishers.
- Newman, G. E., Keil, F. C., Kuhlmeier, V. A., & Wynn, K. (2010). Early understandings of the link between agents and order. *Proceedings of the National Academy of Sciences of the United States of America*, 107(40), 17140-17145.
- Newport, F. (2006). Almost half of the Americans believe humans did not evolve Retrieved 22 December, 2008, from <http://www.gallup.com/poll/23200/Almost-Half-Americans-Believe-Humans-Did-Evolve.aspx>
- Newport, F. (2010). Four in 10 Americans believe in strict creationism Retrieved 10th June, 2011, from <http://www.gallup.com/poll/145286/Four-Americans-Believe-Strict-Creationism.aspx>
- Nilsson, D. E., & Pelger, S. (1994). A pessimistic estimate of the time required for an eye to evolve. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 256(1345), 53-58.
- Numbers, R. L. (2006). *The creationists. From scientific creationism to Intelligent Design* (Expanded ed.). Cambridge: Harvard University Press.
- Numbers, R. L. (2007). Darwinism, creationism and Intelligent Design. In A. J. Petto & L. R. Godfrey (Eds.), *Scientists confront Intelligent Design and creationism* (pp. 31-58). New York: W.W. Norton & Company.
- Numbers, R. L. (2009). Myth 24. That creationism is a uniquely American phenomenon. In R. L. Numbers (Ed.), *Galilei goes to jail and other myths about science and religion* (pp. 215-223). Cambridge MA: Harvard University Press.
- Numbers, R. L. (2010). Simplifying complexity: patterns in the history of science and religion. In T. Dixon, G. Cantor & S. Pumfrey (Eds.), *Science and religion. New historical perspectives* (pp. 263-282). Cambridge: Cambridge University Press.
- Numbers, R. L. (2011). Clarifying creationism: five common myths. *History and Philosophy of the Life Sciences*, 33(1), 129-139.
- O'Leary, D. (2006). *Roman Catholicism and modern science. A history*. New York: Continuum.
- O'Leary, D. (2009). From the *Origin to Humani Generis*: Ireland as a case study. In L. Caruana (Ed.), *Darwin and Catholicism. The past and present dynamics of a cultural encounter* (pp. 13-26). London: T&T Clark.
- Oda, R., Niwa, Y., Honma, A., & Hiraishi, K. (2011). An eye-like painting enhances the expectation of a good reputation. *Evolution and Human Behavior*, 32(3), 166-171.
- Orr, H. A. (2002). Book review: No free lunch. *Boston review*(Summer issue).
- Papineau, D. (2005). Philosophical problems of biology. In T. Honderich (Ed.), *The Oxford Companion to Philosophy* (pp. 97). Oxford: Oxford University Press.
- Parliamentary Assembly of the Council of Europe (2007). *Resolution 1580. The dangers of creationism in education*.
- Paul, H. W. (1979). *The edge of contingency. French Catholic reaction to scientific change from Darwin to Duhem*. Gainesville: University Presses of Florida.
- Paul, H. W. (1988). Religion and Darwinism: varieties of Catholic reaction. In T. F. Glick (Ed.), *The comparative reception of Darwinism* (pp. 403-436). Chicago: University of Chicago Press.

- Pelayo, F. (2008). Darwinism and paleontology: reception and diffusion of the theory of evolution in Spain. In E.-M. Engels & T. F. Glick (Eds.), *The reception of Charles Darwin in Europe* (Vol. II, pp. 386-399). London: Continuum.
- Pennock, R. T. (1999). *Tower of Babel. The evidence against the new creationism*. Cambridge: MIT Press.
- Pennock, R. T. (2004). On teaching evolution and the nature of science. In J. Cracraft & R. W. Bybee (Eds.), *Evolutionary science and society: Educating a new generation* (pp. 7-12). Washington: BSCS.
- Pennock, R. T. (Ed.). (2001). *Intelligent Design creationism and its critics. Philosophical, theological and scientific perspectives*. Cambridge: MIT Press.
- Perakh, M. (2002). A free lunch in a mousetrap Retrieved 12 September, 2009, from http://www.talkreason.org/articles/dem_nfl.cfm
- Perakh, M. (2003). The no free lunch theorems and their application to evolutionary algorithms Retrieved 12 September, 2009, from <http://www.talkreason.org/articles/orr.cfm#1>
- Perakh, M. (2004a). There is a free lunch after all. William's Dembski's wrong answers to irrelevant questions. In M. Young & T. Edis (Eds.), *Why Intelligent Design fails. A scientific critique of the new creationism* (pp. 153-171). New Jersey: Rutgers University Press.
- Perakh, M. (2004b). *Unintelligent design*. New York: Prometheus Books.
- Perbal, L. (2005). *Evaluation de l'opinion des étudiants de l'enseignement secondaire et supérieur de Bruxelles vis-à-vis des concept d'évolution (humaine)*. Vrije Universiteit Brussel, Brussels.
- Perry, G. H., Dominy, N. J., Claw, K. G., Lee, A. S., Fiegler, H., Redon, R., et al. (2007). Diet and the evolution of human amylase gene copy number variation. *Nature Genetics*, 39(10), 1256-1260.
- Petrovich, O. (1997). Understanding of non-natural causality in children and adults: A case against artificialism. *Psyche en Geloof*, 8, 151-165.
- Petto, A. J., & Godfrey, L. R. (Eds.). (2007). *Scientists confront Intelligent Design and creationism*. New York: W.W. Norton & Company.
- Phillips, W., Shankar, M., & Santos, L. R. (2010). Essentialism in the absence of language? Evidence from rhesus monkeys (*Macaca mulatta*). *Developmental Science*, 13(4), F1-F7.
- Pigliucci, M., & Boudry, M. (2011). Why machine-information metaphors are bad for science and science education. *Science & Education*, 20(5-6), 453-471.
- Pinker, S. (1997). *How the mind works*. New York: Norton.
- Pinker, S. (2002). *The blank slate. The modern denial of human nature*. London: Pinguin Books.
- Pius XII (1950). *Humani Generis*. Retrieved from http://www.vatican.va/holy_father/pius_xii/encyclicals/documents/hf_p-xii_enc_12081950_humani-generis_en.html
- Plantinga, A. (2001). Methodological naturalism? In R. T. Pennock (Ed.), *Intelligent Design creationism and its critics. Philosophical, theological and scientific perspectives* (pp. 339-361). Cambridge: MIT Press.
- Preston, J., & Epley, N. (2009). Science and God: An automatic opposition between ultimate explanations. *Journal of Experimental Social Psychology*, 45(1), 238-241.
- Price, G. M. (1923). *The new geology. A textbook for colleges, normal schools, and training schools; and for the general reader*. Mountain View: Pacific Press.
- Progenesis (2009). *95 stellingen tegen evolutie. Wetenschappelijke kritiek op het naturalistische wereldbeeld (95 theses against evolution. A scientific critique of the naturalistic worldview)*. Doorn: Johannes Mulitmedia.
- Prothero, D. R. (2007). *Evolution. What the fossils say and why it matters*. New York: Columbia University Press.

- Recanati, F. (1997). Can we believe what we do not understand? *Mind & Language*, 12(1), 84-100.
- Recker, D. (2010). How to confuse organisms with mousetraps: machine metaphors and intelligent design. *Zygon. Journal of religion and science*, 45(3), 647-664.
- Reiss, M. J. (2009). Imagining the World: The Significance of Religious Worldviews for Science Education. *Science & Education*, 18(6-7), 783-796.
- Riexinger, M. (2008). Propagating Islamic creationism on the internet. *Masaryk University Journal of Law and Technology*, 2(2), 99-112.
- Riexinger, M. (2010). Islamic opposition to the Darwinian theory of evolution. In J. R. Lewis & O. Hammer (Eds.), *Handbook of religion and the authority of science* (pp. 483-510). Leiden: Brill.
- Roberts, J. H. (1988). *Darwinism and the divine in America : Protestant intellectuals and organic evolution, 1859-1900*. Madison, Wis.: University of Wisconsin Press.
- Rosenhouse, J. (2002). Probability, optimization theory and evolution. *Evolution and Human Behavior*, 56(8), 1721-1722.
- Rosset, E. (2008). It's no accident: Our bias for intentional explanations. *Cognition*, 108(3), 771-780.
- Roth, A. (1980). Implications of various interpretations of the fossil record Retrieved 26 January, 2009, from <http://www.grisda.org/origins/07071.htm>
- Rudolph, J. L., & Stewart, J. (1998). Evolution and the nature of science: On the historical discord and its implications for education. *Journal of Research in Science Teaching*, 35(10), 1069-1089.
- Ruse, M. (2003). *Darwin and design. Does evolution have a purpose?* Cambridge: Harvard University Press.
- Ruse, M. (2006). *Darwinism and its discontents*. New York: Cambridge University Press.
- Rutledge, M. L., & Mitchell, M. A. (2002). High school biology teachers' knowledge structure, acceptance, and teaching of evolution. *American Biology Teacher*, 64(1), 21-28.
- Rutledge, M. L., & Warden, M. A. (2000). Evolutionary theory, the nature of science and high school biology teachers: critical relationships. *American Biology Teacher*, 62(1), 23-31.
- Sager, C. (Ed.). (2008). *Voices for evolution*. Berkeley: The National Center for Science Education.
- Samarapungavan, A., & Wiers, R. W. (1997). Children's thoughts on the origin of species: A study of explanatory coherence. *Cognitive Science*, 21(2), 147-177.
- Sanders, M., & Ngxola, N. (2009). Identifying teachers' concerns about teaching evolution. [Article]. *Journal of biological education*, 43(3), 121-128.
- Sarkar, S. (2007). *Doubting Darwin? Creationist designs on evolution*. Malden (Mass.): Blackwell.
- Saxe, R., Tenenbaum, J. B., & Carey, S. (2005). Secret agents: Inferences about hidden causes by 10-and 12-month-old infants. *Psychological Science*, 16(12), 995-1001.
- Sayin, Ü., & Kence, A. (1999). Islamic scientific creationism. *Reports of the National Center for Science Education*, 19(6), 18-20, 25-29.
- Schilders, M., Sloep, P., Peled, E., & Boersma, K. (2009). Worldviews and evolution in the biology classroom. *Journal of Biological Education*, 43(3), 115-120.
- Schönborn, C. K. (2005, July 7). Finding design in nature. *New York Times*, from http://www.nytimes.com/2005/07/07/opinion/07schonborn.html?_r=1&adxnnl=1&pagewanted=print&adxnnlx=1296564222-3gwk+/LqusqY20lZUErgsQ
- Schönborn, C. K. (2007a). Fides, Ratio, Scientia. Zur Evolutionismusdebatte *Schöpfung und Evolution. Eine Tagung mit Papst Benedikt XVI in Castel Gandolfo* (pp. 79-98). Augsburg: Sankt Ulirch Verlag.
- Schönborn, C. K. (2007b). *Ziel oder Zufall? Schöpfung und Evolution aus der Sicht eines vernünftigen Glaubens*. Freiburg: Herder.

- Scott, E. C. (2004). *Evolution vs. creationism. An introduction*. Berkeley: University of California Press.
- Scott, E. C. (2006). The once and future Intelligent Design. In E. C. Scott (Ed.), *Not in our classrooms. Why Intelligent Design is wrong for our schools* (pp. 1-27). Boston: Beacon Press.
- Scott, E. C. (2007). Creation science lite. 'Intelligent Design' as the new anti-evolutionism. In A. J. Petto & L. R. Godfrey (Eds.), *Scientists confront Intelligent Design and creationism* (pp. 59-109). New York: W.W. Norton & Company.
- Scott, E. C. (2009). *Evolution vs. creationism. An introduction* (2nd ed.). Westport: Greenwood Press.
- Shallit, J. (2002). Book review: No free lunch. *Biosystems*, 66(93-99).
- Shanks, N., & Joplin, K. H. (1999). Redundant complexity: A critical analysis of intelligent design in biochemistry. *Philosophy of Science*, 66(2), 268-282.
- Shermer, M. (2002). *Why people believe weird things. Pseudoscience, superstition, and other confusions of our time. Revised and expanded*. New York: Holt Paperbacks.
- Shtulman, A. (2008). Variation in the anthropomorphization of supernatural beings and its implications for cognitive theories of religion. *Journal of Experimental Psychology-Learning Memory and Cognition*, 34(5), 1123-1138.
- Shtulman, A., & Schulz, L. (2008). The relation between essentialist beliefs and evolutionary reasoning. *Cognitive Science*, 32(6), 1049-1062.
- Shubin, N. (2008). *Your inner fish : a journey into the 3.5-billion-year history of the human body* (1st ed.). New York: Pantheon Books.
- Sinatra, G. M., Brem, S., & Evans, E. (2008). Changing Minds? Implications of Conceptual Change for Teaching and Learning about Biological Evolution. *Evolution: Education and Outreach*, 1(2), 189-195.
- Sinatra, G. M., & Nadelson, L. (2011). Science and religion. Ontologically different epistemologies? In R. S. Taylor & M. Ferrari (Eds.), *Epistemology and science education. Understanding the evolution vs. Intelligent Design controversy* (pp. 173-193). New York: Routledge.
- Slingerland, E., & Chudek, M. (2011). The prevalence of mind-body dualism in early China. *Cognitive Science*.
- Slooman, S. A. (1996). The empirical case for two systems of reasoning. *Psychological Bulletin*, 119(1), 3-22.
- Slone, J. (2004). *Theological incorrectness. Why religious people believe what they shouldn't*. Oxford: Oxford University Press.
- Smedes, T. A. (2005). 'Intelligent Design'. Is het wetenschap of theologie? Achtergronden van een groeiende controverse (Intelligent Design. Is it science or theology? Background to a growing controversy). *Nederlands Theologisch Tijdschrift*, 59, 106-123.
- Smedes, T. A. (2006). Theologie, natuurwetenschap en het probleem van de menselijke maat (Theology, natural science and the problem of the human dimension). In C. Dekker, R. Meester & R. Van Woudenberg (Eds.), *En God beschikte een worm. Over schepping en evolutie* (pp. 101-113). Kampen: Ten Have.
- Smelik, P. (2007). Scheppingsgeloof of toevalsgeloof? (Belief in creation or belief in chance?). In C. Dekker, R. Van Woudenberg & G. Van den Brink (Eds.), *Omhoog kijken in Platland* (pp. 165-180). Kampen: Ten Have.
- Sober, E. (2008). *Evidence and evolution. The logic behind the science*. Cambridge: Cambridge University Press.
- Spelke, E., Phillips, A., & Woodward, A. L. (1995). Infants' knowledge of object motion and human action. In D. Sperber, D. Premack & A. J. Premack (Eds.), *Causal cognition. A multidisciplinary debate* (pp. 44-78). Oxford: Clarendon Press.

- Sperber, D. (1996). *Explaining culture. A naturalistic approach*. Oxford: Blackwell.
- Sperber, D., Clement, F., Heintz, C., Mascaro, O., Mercier, H., Origgi, G., et al. (2010). Epistemic Vigilance. *Mind & Language*, 25(4), 359-393.
- Stamos, D. N. (2008). *Evolution and the big questions. Sex, race, religion and other matters*. New York: Henry Holt and Company.
- Stebbins, R. E. (1988). France. In T. F. Glick (Ed.), *The comparative reception of Darwinism* (pp. 117-163). Chicago: University of Chicago Press.
- Szerszynski, B. (2010). Understanding creationism and evolution in America and Europe. In T. Dixon, G. Cantor & S. Pumfrey (Eds.), *Science and religion. New historical perspectives* (pp. 153-174). Cambridge: Cambridge University Press.
- Tentori, K., Bonini, N., & Osherson, D. (2004). The conjunction fallacy: a misunderstanding about conjunction? *Cognitive Science*, 28(3), 467-477.
- Thagard, P., & Findlay, S. (2010). Getting to Darwin: Obstacles to Accepting Evolution by Natural Selection. *Science & Education*, 19(6), 625-636.
- Thaxton, C. B., Bradley, W. L., & Olsen, R. L. (1984). *The mystery of life's origin. Reassessing current theories*. New York: Philosophical Library.
- Tooby, J., & Cosmides, L. (1992). The biological foundations of culture. In J. Barkow, J. Tooby & L. Cosmides (Eds.), *The adapted mind. Evolutionary psychology and the generation of culture* (pp. 19-136). New York: Oxford University Press.
- Tooby, J., & Cosmides, L. (2005). Conceptual foundations of evolutionary psychology. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 5-67). Hoboken: John Wiley & Sons.
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: heuristics and biases. *Science*, 185(4157), 1124-1131.
- Tversky, A., & Kahneman, D. (1983). Extensional versus intuitive reasoning: the conjunction fallacy in probability judgment. *Psychological Review*, 90(4), 293-315.
- Van den Beukel, A. (1990). *De dingen hebbenn hun geheim. Gedachten over natuurkunde, mens en God (Things have their secrets. Thoughts on physics, man and God)*. Baarn: Ten Have.
- Van den Beukel, A. (1994). *Met andere ogen. Over wetenschap en het zoeken naar zin (With different eyes. On science and the search for meaning)*. Baarn: Ten Have.
- Van den Beukel, A. (2006). De wereld. Schepping of toevalstreffer? (The world. Creation or stroke of luck?). In C. Dekker, R. Meester & R. Van Woudenberg (Eds.), *En God beschikte een worm. Over schepping en evolutie* (pp. 198-211). Kampen: Ten Have.
- Van Woudenberg, R. (2002). *Ontwerp en toeval in de wereld (Design and chance in the world)*. Amstelveen: De zaak Haes.
- Van Woudenberg, R. (2003). *Toeval en ontwerp in de wereld. Apologetische analyses (Chance and design in the world. Apologetic analyses)*. Budel: Damon.
- Van Woudenberg, R. (2006). Houdingen inzake evolutie en schepping (Attitudes towards evolution and creation). In C. Dekker, R. Meester & R. Van Woudenberg (Eds.), *En God beschikte een worm. Over schepping en evolutie* (pp. 180-197). Kampen: Ten Have.
- Verhey, S. D. (2005). The effect of engaging prior learning on student attitudes toward creationism and evolution. *Bioscience*, 55(11), 996-1003.
- Vosniadou, S., & Ioannides, C. (1998). From conceptual development to science education: a psychological point of view. *International Journal of Science Education*, 20(10), 1213-1230.
- Vosniadou, S., Vamvakoussi, X., & Skopeliti, I. (2008). The framework theory approach to the problem of conceptual change. In S. Vosniadou (Ed.), *International handbook of research on conceptual change* (pp. 3-34). New York: Routledge.

- Wein, R. (2002a). Not a free lunch but a box of chocolates. A critique of William Dembski's book *No free lunch* Retrieved 15 September, 2009, from <http://www.talkorigins.org/design/faqs/nfl>
- Wein, R. (2002b). Response? What response? How Dembski has avoided addressing my arguments Retrieved 17 September, 2009, from <http://www.talkorigins.org/design/faqs/nfl/replynfl.html>
- Wells, J. (2000). *Icons of evolution. Science or myth? Why much of what we teach about evolution is wrong*. Washington D.C.: Regnery.
- Wells, J. (n.d.). Ten questions to ask your biology teacher about evolution Retrieved 5 November 2009, from <http://www.iconsofevolution.com/tools/questions.php3>
- Whitcomb, J. C., & Morris, H. M. (1961). *The Genesis Flood. The biblical record and its scientific implications*. Philadelphia: The Presbyterian and Reformed Publishing Company.
- Wijnands, Z. (2009). *God of Darwin. Kan wetenschap om de Bijbel heen? (God or Darwin. Can science neglect the Bible?)*. Elbrug: Ipenburg.
- Wiker, B. (2002). *Moral Darwinism. How we became hedonists*. Downers Grove: Intervarsity Press.
- Wilder-Smith, A. E. (1970). *The creation of life. A cybernetic approach to evolution*. Wheaton: Harold Shaw Publishers.
- Williams, J. (2008). Creationist Teaching in School Science: A UK Perspective. *Evolution: Education and outreach*, 1(1), 87-95.
- Wilson, D. S. (2005). Evolution for everyone: How to increase acceptance of, interest in, and knowledge about evolution. *Plos Biology*, 3, 2058-2065.
- Wolpert, D. (2002). William Dembski's treatment of the no free lunch theorems is written in jello Retrieved 17 September, 2009, from <http://www.talkreason.org/articles/jello.cfm>
- Wolpert, D., & Macready, W. (1997). No free lunch theorems for optimization. *IEEE Transactions on evolutionary computation*, 1(1), 67-82.
- Wysong, R. L. (1976). *The creation-evolution controversy (implications, methodology and survey of evidence)*. Midland: Inquiry Press.
- Yahya, H. (1999). *The evolution deceit. The scientific collapse of Darwinism and its ideological background*. London, UK: Ta-Ha Publishers.
- Young, C. C., & Largent, M. A. (2007). *Evolution and creationism : a documentary and reference guide*. Westport (Conn.): Greenwood press.
- Young, M. (2004). Grand designs and facile analogies. Exposing Behe's mousetrap and Dembski's arrow. In M. Young & T. Edis (Eds.), *Why Intelligent Design fails. A scientific critique of the new creationism* (pp. 20-31). New Brunswick: Rutgers University Press.
- Young, M., & Edis, T. (2006). *Why intelligent design fails. A scientific critique of the new creationism*. New Brunswick: Rutgers University Press.
- Young, M., & Edis, T. (Eds.). (2004). *Why Intelligent Design fails. A scientific critique of the new creationism*. New Brunswick: Rutgers University Press.
- Yu, F., Hill, R. S., Schaffner, S. F., Sabeti, P. C., Wang, E. T., Mignault, A. A., et al. (2007). Comment on "Ongoing adaptive evolution of ASPM, a brain size determinant in Homo sapiens". *Science*, 316(5823).

Appendix Civil initiative Fair Science

We, defenders of honest and transparent data use in science, science policy and education plea for the use of 'fair science' as a guiding principle for scientific practice in scientific research, science policy and education in the Netherlands.

Fair science entails that:

- 1) A clear distinction is to be made between facts and interpretations. The interpretation framework (set of presuppositions) has to be spelled out in an honest manner.
- 2) A scientific model, its origin history included, is not to be portrayed better or worse than it actually is.
- 3) A scientific model is not to be presented as untouchable or as matching the truth.
- 4) Competitive scientific models are not to be neglected.
- 5) Concerning the origin of species, equal attention is to be given to the framework of evolution on the one hand and the framework of creation on the other.

Fair science is needed on the condition that it is grounded by the following 22 considerations:

- 1) Acquiring and applying scientific knowledge is of great economic and social importance in our society;
- 2) Scientific practice is impossible without having an interpretation framework in mind (paradigm, set of presuppositions or starting-points);

- 3) This interpretation framework ascribes a certain meaning to research data and has an impact on the direction of new research;
- 4) The choice of an interpretation framework is a subjective choice, which is made on the basis of pre-scientific considerations;
- 5) A scientific model, which is built upon an interpretation framework, should not be equated with fact or truth
- 6) A scientific model is never to be considered as “proven”, merely as “corresponding more or less to the facts”; (points 2 to 6 are well known within philosophy of science)
- 7) Concerning the origin of the universe, the international scientific community exhibits two different interpretation frameworks (each having their own corresponding models), namely the evolution framework (according to which billions of years of evolution have characterized the universe as we know it today) and the framework of creation (according to which the universe was created a couple of thousand years ago);
- 8) The scientific models that accompany both frameworks came to be through applications of the scientific method;
- 9) The scientific models that accompany both frameworks are not to be presented as facts or truth;
- 10) However, scientific research, science policy and education in the Netherlands present the evolution framework as a fact or as truth;
- 11) This model is commonly used as the only model explaining origins in scientific research, science policy and education;
- 12) Consequently, the model of creation is being neglected in scientific research, science policy and education;
- 13) Children and adult civilians have a right to being informed and are entitled to having their own opinion, but this way they only receive one-sided information by which they cannot freely form their own opinion;
- 14) In a society where freedom of opinion is important, the free formation of opinion should be equally valuable;
- 15) The situation mentioned in points 10 through 13 implies an abusing of science and a constraint on the freedom of thought;
- 16) This one-sided application of the evolution framework ignores both the available alternative as well as facts that cannot be explained within the preferred framework;
- 17) This one-sided application of the evolution framework leads to suboptimal (sometimes even considerably flawed) explanations of the physical reality, accompanied by demonstrable technical failure, economic losses, misjudgment or even reinterpretation of history, loss of moral judgment and conduct in society, and emotional damage through social exclusion and career loss;

- 18) This one-sided approach trickles down into the views on many other scientific and societal puzzles, such as the value of human life, the relationship between man and nature and the climate debate;
- 19) An approach, which keeps an open mind in respect to both frameworks, leads to a better explanation of the physical reality, can limit or even prevent technical failure and economic losses, has no need to misjudge or rewrite history, confines the loss of moral judgment and conduct and causes less or no emotional damage through social exclusion and career loss;
- 20) An open minded approach is logical and fair, as soon as one makes an honest distinction between facts on the one hand and interpretations on the other;
- 21) Making an honest distinction between facts and interpretations does not go against the principle of academic freedom, but is able to meet the pressing demand for critical reflection within the sciences and helps to optimize this freedom to its fullest extent;
- 22) The government needs to provide policy frameworks that enable scientific practice to function optimally in service to society.

