Ideas about **naturalness** in public and political debates about science, technology and medicine

ANALYSIS PAPER

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NUFFIELD COUNCIL ON BIOETHICS

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Foreword

This year ideas about naturalness seem to be everywhere: “How dare you refer to my beautiful children as ‘synthetic’?” tweeted Elton John in March 2015 in an argument with Dolce and Gabbana. Bishop Keenan of Paisley argued that a technique to prevent mitochondrial DNA disorders “distorts the natural process of fertility” when it was being debated in Parliament in February.

The concept often arises in debates about the ethics of science and medicine. You only have to look at the discussion around genetic modification, cloning, assisted reproduction and food and farming, for example, to see how widespread this rhetorical device has become. And food and drink manufacturers are forever promoting their products by claiming they are natural and better or healthier than synthetic ones. In some cases – such as genetic modification – ideas of unnaturalness may be used to argue against the use of new technologies. In others – such as pre-implantation genetic diagnosis of embryos – the recourse to what would already exist in nature may be deployed in support of novel medical techniques.

With a myriad of ‘unnatural’ scientific advances on the horizon, it was time for us to explore how public and political debates are affected by ideas about naturalness. Not least because if people say that something should or should not be done on the basis of their ideas about naturalness or unnaturalness, that can have a major impact on the development and uptake of technologies, and on our society and culture more widely.

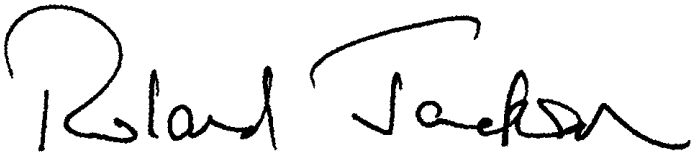
In an attempt to create a window into recent public and political debates where ideas about naturalness have been deployed, we analysed media articles, Parliamentary debates, research on the views of the public, and the work of relevant organisations (including ourselves). We consulted both people professionally engaged in public and political debate, such as journalists, scientists and campaigners, and people who previously had little reason to give the issue any thought.

This work has provided us with, we believe, some unique insights. Two findings stand out for me. The first is that there are noticeable differences between the ways the idea of naturalness is invoked by scientific organisations compared to the other groups we looked at. The second is that the terms *natural*, *unnatural* and *nature* are often used as placeholders for a range of different values or concerns that are meaningful and important to people. As a consequence, there is danger that when we discuss novel science and technology using these terms we are not fully understanding one other and so fail to make progress in debating these difficult issues.

We offer here a description and analysis of the way these ideas are used in public discourse, to aid our mutual understanding and to enable more constructive debate – beyond the surface rhetoric – about issues that speak to our deepest values and beliefs.

On behalf of the Steering Group I should like to add our thanks to three people in particular at the Nuffield Council on Bioethics Secretariat who have put such time and effort into the project: Catherine Joynson, Programme Manager, who directed it;

Anna Wilkinson, Programme Officer, who did the bulk of the research and writing; and Tom Burton, Temporary Researcher, who helped carry out the reviews of media and Parliamentary sources and research on public perspectives on naturalness.



Roland Jackson
Chair of the Steering Group

Acknowledgments

Many people have contributed to this project. We would like to thank Dr Anna Smajdor of the University of East Anglia, who wrote the Council's background paper on naturalness which comprehensively set out the relevant issues and helped to shape the Steering Group's approach to the project. We are indebted to Professor Tim Lewens of the University of Cambridge and Dr Darian Meacham of the University of the West of England who have provided invaluable guidance, advice and feedback on the research and drafting involved in preparing this paper, for which we are very grateful. We also thank Dr Ken Taylor of Newcastle University who provided useful input on methodological aspects of the review of media, Parliamentary, civil society and science sources.

We would also like to thank those who took part in our expert and non-expert meetings held in September and October 2015, respectively. Discussions at these meetings were important in shaping the Steering Group's thinking on the topic and in formulating our recommendations.

The project was greatly enriched by the contribution of our resident poet Kayo Chingonyi and by the three winners of, and over 150 entrants to, the Council's Naturalness poetry competition.

Summary

Ideas about naturalness can inform or underlie people's opinions about science, technology and medicine. Views about what is natural or unnatural may influence the degree to which technologies aiming to treat disease, aid fertility or support food production, for example, are embraced or opposed.

Over the past nine months, the Nuffield Council on Bioethics has explored different ideas about naturalness and identified some of the ways that these feature in and affect public discussions about the ethics of science, technology, and medicine.

The outcomes of our work are presented in this paper. We conclude with recommendations for those involved in public debate that aim to improve communication and understanding between people with different views about naturalness.

Approach and method

Evidence on the ways that ideas about naturalness feature in public debates was collected in seven ways:

1. A review of how the terms *natural*, *unnatural* and *nature* have been used in media articles, Parliamentary debates, and the reports of civil society and science organisations from the last 20 years.
2. A short summary of how the terms *natural* and *nature* are used and regulated in the commercial sector.
3. A literature review of research into public perspectives on nature and naturalness published in the past 15 years.
4. A review of how the concept of naturalness has been used and discussed within the previous work of the Nuffield Council on Bioethics.
5. A roundtable meeting with experts to discuss the issues, test the project findings, and generate ideas and feedback on possible recommendations.
6. A dialogue meeting with members of the public to discuss the issues, test the project findings, and generate ideas and feedback on possible recommendations.
7. A poetry residency which provided ways of thinking creatively about naturalness and generated alternative insights on the topic.

This paper presents and discusses the evidence gathered alongside references to relevant regulation and guidance, and academic discussions of ideas relating to naturalness within philosophy, the social sciences, and bioscience.

Introduction

Debate about novel science, technology and medicine in the public domain often makes appeal to what is natural and unnatural. People sometimes express a desire to use, consume or practice things they would describe as natural, and criticise or condemn things that they see as unnatural. Assisted conception, genetic modification, cloning, and the use of cosmetic procedures to enhance appearance, for example, are all sometimes described as unnatural and compared, disfavourably, with natural alternatives. For example:

> *"The creation of hybrid embryos undermines our dignity and is fundamentally disrespectful of the boundaries of nature… there is a sense that it blurs the distinction between animals and humans, creating* ***unnatural*** *entities."* (Parliamentary debate on Human Fertilisation and Embryology Bill, 2008)

> *"The instinctive desire within many of us not to consume something that is "****unnatural****" – the fear of so-called "Frankenfoods"."* (The Guardian, 2012)

> *"I don't have any concerns about stem cells – they aren't man-made like Botox. I feel reassured about the safety because it is a* ***natural*** *product."* (The Sun, 2013)

Commending, praising, or favouring something on the basis of its being natural, or criticising, condemning, or disapproving of something on the grounds that it is unnatural connects the notion of what is natural with value.

Ideas about naturalness are not conveyed solely by using the terms *natural* and *unnatural*. The terms *normal*, *pure*, *real*, *organic*, *unadulterated*, *unprocessed* and numerous others are used in place of *natural*; *artificial, fake, abnormal, synthetic* and others can be used as synonyms for *unnatural*. Each of these words has slightly different connotations and some, with strongly approving or disparaging intrinsic associations, carry more positive or negative force than others.

There are quite different ways of characterising or viewing the natural. Ideas about nature can incorporate notions of wisdom, purity, sanctity, balance and harmony. The natural can also be perceived as involving power, danger, chaos and disorder. What is considered to be natural or unnatural also changes over time. Some things that were condemned for being unnatural in the past are now seen as normal and acceptable. The concept of nature itself, and perceptions about the link between nature and value, also change and are reflected differently in philosophy, social science, and literature at different points in history.

Associating what is natural with what is good and what is unnatural with what is bad is not, therefore, straightforward: it is difficult to define natural and unnatural things or processes. If natural things are those that have not been subject to human intervention, then very natural-seeming cultural activities, which it may sound odd to describe as *unnatural*, such as cooking and writing, are excluded. Yet defining natural things as 'everything that exists in the natural world' seems too inclusive. In addition it is not obvious that we should associate what is natural with what is good, and what is unnatural with what is bad. There are natural things that are widely considered to be bad, like disease and earthquakes, and unnatural things that can be good, like medicine. For these reasons, many are sceptical about straightforward appeals to what is natural or unnatural as a mean of distinguishing what is good and bad, or acceptable and unacceptable.

Wholly sceptical views concerning arguments based on ideas about naturalness, however, are not fully sensitive to the wide variety of notions, assumptions and associations that different people have and make about what is natural and unnatural. Voicing concerns about unnatural technologies can be a means of

expressing indistinct or hard-to-articulate unease about new technologies that challenge the way we think about health, food, reproduction, recreation and other activities and processes. Ideas about the naturalness or unnaturalness of technologies can be thought of as 'placeholders' for a range of other values or concerns.

The role of naturalness in debates about science, technology and medicine

We explored the ways in which the terms *natural*, *unnatural,* and *nature* were used in public debates by reviewing media articles, Parliamentary debates, and recent reports of civil society and science organisations. Uses of the terms were sorted into one of four categories (value-laden, value-neutral, borderline cases, and discussion uses) which directly questioned or queried the connection between naturalness and value. We then identified common themes and ideas associated with uses of these words.

Our work identified a range of uses of the terms *natural*, *unnatural,* and *nature* in value-laden contexts in media articles, Parliamentary debates and the reports of civil society organisations. These uses were found within a wide range of discussions of science, technology, and medicine including genetically modified crops, assisted conception, cosmetic procedures, cloning, mitochondrial donation, sports science, alternative medicine, and death and dying.

However, within the publications of organisations representing scientists, value-laden uses of the words *natural*, *unnatural* and *nature* were almost non-existent, suggesting that many scientists do not generally see naturalness as connected to value.

Within media articles, there was a noticeably larger proportion of value-laden uses of the words *natural* and *unnatural* in non-news articles (such as editorials, features, and comment pieces) when compared with news articles.

There was an asymmetry between the regularity with which value was invoked by use of the term *natural* and the term *unnatural*. Within the sources reviewed, the term *natural* was used much more commonly than the term *unnatural* and was usually used in a value-neutral way. In contrast, when the term *unnatural* was used, it was often used to suggest something is wrong or bad.

We also explored how the terms *natural, unnatural,* and *nature* are used and regulated in the promotion and marketing of commercial products including food and drink, complementary and alternative medicinal products and nutritional supplements, cosmetics, and household cleaning products. There are differences in how use of the term *natural* in marketing material is regulated for different products, and consumer research suggests that people are confused by its use in some retail contexts.

Accounts of naturalness

The examples identified during our exploration of public debate show that diverse ideas, associations, anxieties, hopes and fears underlie people's uses of the terms

natural, unnatural and *nature*. In this paper, we set out five broad themes running through these examples, corresponding to five accounts of naturalness. These ideas are closely related to one another and overlap in significant ways.

It is important to note that we do not attempt to take a position on which, if any, of these might be a correct view of naturalness. Our aim is simply to elucidate the different ways that these terms are used.

1 *Neutral/sceptical account:* this view of the natural is held by those who are sceptical about the existence of any strong link between naturalness and value.

2 *Wisdom of nature:* this account of naturalness is linked to ideas about the risks attached to novel science and the pitfalls of failing to respect what is sometimes termed the *wisdom of nature*. It can involve the notion that we should trust in or rely on natural or evolved processes and make use of natural means of reproducing, eating, and healing.

3 *Natural purpose:* this account of naturalness concerns what people, animals and plants are meant to do or be like, grounded in natural or evolved functions. This may derive from the natures, functions, or essences of beings, which determine what is good or right for those beings.

4 *Disgust and monstrosity:* this account of naturalness concerns the kinds of responses that people have to some novel technologies. These may be responses of disgust, repugnance, or revulsion, or may be linked to ideas about monstrosity, horror, and notions from science fiction.

5 *God and religion:* this account of naturalness involves the idea that certain technologies serve to undermine a divine natural order, distort God's creation, or otherwise contravene the will of God.

The diverse set of ideas associated with naturalness, which vary between people and over time, may have implications for the usefulness of the terms *natural* and *unnatural* in public discussions about science, technology and medicine. It is possible that the different associations people make with the natural mean that people end up speaking at cross-purposes, or 'talking past' one another – using identical terms with different meanings – when using these words and thereby fail to fully understand one another. This means that effective communication on the ethics of science, technology, and medicine may be hindered, rather than helped, by appeals to naturalness.

Recommendations

For individuals

- To avoid us speaking at cross-purposes, we should all be aware that people can use the terms *natural, unnatural*, and *nature* as placeholders for a range of different important values or beliefs in relation to science, medicine, and technology.

For organisations representing scientists and other sectors of society

- Organisations that contribute to public and political debates about science, technology, and medicine should avoid using the terms *natural, unnatural* and *nature* without conveying the values or beliefs that underlie them.

- Such organisations should explore and engage with the values and beliefs underlying use of the terms *natural, unnatural* and *nature* in debates about science, technology and medicine to ensure that the views of different people are fully understood, debated, and taken into account.

For policy-makers

- Policy-makers, including Parliamentarians, should avoid using the terms *natural, unnatural* and *nature* when talking about science, medicine and technology without conveying the values or beliefs that underlie them.

- Policy-makers should explore fully what people mean when they use the terms *natural, unnatural* and *nature* when engaging with the general public to inform the development of science or health policy.

For journalists

- Journalists should avoid using the terms *natural, unnatural* and *nature* when talking about science, medicine and technology without conveying the values or beliefs that underlie them.

For manufacturers and advertisers

- Manufacturers and advertisers of, for example, food, cosmetics and health products should be cautious about describing a product as *natural* given the ambiguity of this term and that it is unlawful to mislead consumers, and should follow relevant guidance on advertising and labelling.

1. Approach and method

Ideas about naturalness can inform or underlie people's opinions about science, technology and medicine, and ultimately their acceptance or rejection of new technologies. These ideas therefore play an important role in how the public see the acceptability of advances in science and medicine and influence the degree to which technologies aiming to treat disease, aid fertility or support food production, for example, are embraced or opposed by the public.

In 2015, the Nuffield Council on Bioethics decided to explore how ideas about naturalness feature in public debates about the ethics of science, technology and medicine, and examine the ways that that these ideas correlate with academic perspectives on naturalness. The aim was to use the outcomes of this work to promote informed debate about the way that ideas about naturalness influence public discussions about these topics. A description of the approach and methods used by the Council is provided below.

All aspects of the project were overseen by a Steering Group made of members of the Nuffield Council on Bioethics with appropriate expertise. The members were.

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Evidence gathering

In order to investigate the ways that ideas about naturalness feature in debates on the ethics of science, technology and medicine, evidence was collected from a range of sources. Evidence gathering activities included seven main strands:

1. **Review of sources: the media, Parliament, civil society, and science organisations**

A review was conducted of use of the terms *natural*, *unnatural* and *nature* in public debates on the ethics of science, technology and medicine in the media and by

Parliamentarians, civil society organisations and science organisations. This exercise covered discussion of science, technology and medicine within selected newspapers and online media sources from the last five years; Parliamentary statements and debate conducted by MPs and Lords and documented in the Hansard record from the last ten years; reports, briefings and other publications of selected civil society organisations interested in bioethics issues, including charities, campaigning organisations and NGOs from the last 20 years; and the reports and other publications of selected learned societies and organisations representing the views of scientists from the last 20 years.

Material on a range of topics was examined and uses of the terms *natural*, *unnatural* and *nature* were sorted into one of four different categories: value-laden, value-neutral, borderline cases and discussion uses.

The review identified a range of examples on topics covering genetic modification, food and farming, cloning, assisted reproduction and childbirth, cosmetic procedures, xenotransplantation, complementary healthcare, end of life care, and sports science and the use of prosthetics.

This work explored the ways that the terms *natural*, *unnatural* and *nature* are used to discuss science, technology, and medicine in these different areas of public discourse. It provides insight into the regularity with which these terms are used to invoke ideas about value, within discussion of these topics. The exercise also aimed to identify differences in how these words are used in the context of particular areas of science, technology, and medicine, and in different sources of public debate. Some of the less obvious ways in which naturalness features in public debate are also explored.

A report providing full details of this work has been published separately and is available here.

2. Summary of use in commercial sector

A review of how use of the terms *natural* and *nature* are currently regulated in different parts of the commercial sector was conducted. This work identified a number of examples of different kinds of products, including food and drink, complementary and alternative medicines and health supplements, cosmetics, and household cleaning products, which are described as natural, or which refer to nature, in labelling and promotional materials. We set out the relevant regulations and guidance, and describe the role of organisations including the Advertising Standards Authority, the Medicines and Healthcare products Regulatory Agency, and the Food Standards Agency in this field.

3. Review of research on public perspectives

A review of research into public views and public dialogue activities was conducted, which investigated how people perceive naturalness and the meaning of the word *natural*. The review explores academic work conducted on this topic with members of the public over the last 15 years in the UK and other western countries.

The review aimed to identify common themes and ideas running through public views on naturalness, and how they relate to public perceptions on the ethics of science, technology, and medicine. This review covered existing work which explores attitudes towards biotechnology, genetic modification, food and farming, the environment, xenotransplantation, assisted reproduction and childbirth, cosmetic procedures, and complementary and alternative medicine.

A report providing full details of this work has been published separately and is available here.

4. Review of Nuffield Council on Bioethics' reports

The Nuffield Council on Bioethics has conducted inquiries into a number of topics for which the concept of naturalness is relevant. We reviewed ways in which the notion has been used, cited and discussed within these reports and explored whether and how the notion of naturalness has informed the Council's thinking about relevant topics.

Council reports for which ideas about naturalness are relevant include xenotransplantation, genetically modified crops, animals in research, donor conception, biofuels, donation of human bodies for medicine and research, mitochondrial donation and emerging biotechnologies.[1] The reports were written over a period spanning 16 years, with the first, *Animal-to-human transplants: the ethics of xenotransplantation* published in 1996 and the most recent, *Emerging biotechnologies: technology, choice and the public good* published in 2012.

A report providing full details of this work has been published separately and is available here.

5. Roundtable meeting with experts

In September 2015, a meeting with experts in relevant fields brought together 25 people with professional experience of public debates about science, including journalists, Government officials, an ex-MP and Parliamentary staff, scientists, representatives of civil society groups, and academic researchers. The meeting provided an opportunity to discuss the issues, test project findings, and generate ideas and feedback on possible recommendations.

6. Dialogue meeting with members of the public

In October 2015, a meeting with members of the public was organised and facilitated by Dialogue by Design involving a diverse group of 13 members of the public who had no professional or particular experience of the topic. The meeting provided an opportunity to discuss the issues, test project findings, and generate ideas and feedback on possible recommendations.

Separate report available here.

7. Poetry residency

[1] For a full list of Council reports, see: Nuffield Council on Bioethics (2015) *Previous work*, available at: http://nuffieldbioethics.org/previous-work/.

The Council commissioned poet Kayo Chingonyi to help think creatively about how words and language are used to express ideas about naturalness. Kayo produced an initial piece of work based on his early thoughts on the topic in August 2015 and further works towards the conclusion of the project in November 2015. All of the poems are available to view here. Kayo's contributions also informed some of the ideas presented in this report.

Analysis paper

This paper draws together evidence gathered using the methods described above. It explores the range of different ideas and associations that appear to underlie positive and negative associations made with naturalness within public discussions of science, technology and medicine in the UK in the recent past, and identifies key themes and ideas running through these claims about the natural. The paper reviews the guidance and law on the use of the term in the promotion and marketing of commercial products. It also incorporates a wide range of relevant academic thinking from philosophy, social sciences, and the biosciences to provide a theoretical perspective on these ideas.

2. Ideas about naturalness

Section summary

- Sometimes claims about what is natural and unnatural in debates about the ethics of science, technology, and medicine connect naturalness with value.
- There are many different words, such as *synthetic*, *artificial* and *fake*; and *normal, pure* and *organic,* that are used in public debates to express these ideas about naturalness.
- There is an asymmetry in how the terms *natural* and *unnatural* are used in these contexts.
- It can be difficult to define *natural* and draw a robust distinction between what is natural and unnatural.
- Naturalness can mean different things to different people.
- What is seen as natural and unnatural changes over time.
- The different ways that people use the terms *natural* and *unnatural* may mean that people end up speaking at cross-purposes with each other.

2.1 Associating value with naturalness

Often when people describe something as *natural* or *unnatural* in the context of a debate about science, technology, or medicine they are using those terms to make claims about that thing being good or bad, or right or wrong.

It is sometimes said, for example, that genetic modification of plants and animals is unnatural. The use of techniques enabling women to give birth in their sixties, or to select embryos with particular features, can also be described this way. The cloning of humans and non-human animals, *in vitro* meat, xenotransplantation, and the use of performance enhancing drugs and prosthetics, are all sometimes said to be unnatural too. Some examples of this from public debate include the following:

> *"... wider debate over sperm banks and "designer babies". It's selfish and **unnatural**, say the critics. It's treating babies like puppies and handbags..".* (The Telegraph, 2014)

> *"... foetal and embryonic stem cell research is unethical, **unnatural**".* (The Daily Mail, 2010)

> *"The creation of hybrid embryos undermines our dignity and is fundamentally disrespectful of the boundaries of nature… there is a sense that it blurs the distinction between animals and humans, creating **unnatural** entities."*
> (Parliamentary debate on the Human Fertilisation and Embryology Bill, 2008)

When these things are described as unnatural in the context of public debate, it is often being suggested that they are wrong, and that it is the *unnaturalness* that makes them wrong.

Similarly, when people contrast genetically modified food with 'naturally grown' food, or food containing natural ingredients, they often mean to say something positive. Natural ingredients are taken to be better than genetically modified, pesticide-treated, or processed alternatives; describing food, health remedies, cosmetics, and other products as natural is often a means of recommending or endorsing those things. Natural techniques or processes are implied to be superior to artificial alternatives. Some examples of this kind include the following:

> *"IVF is one of the best inventions of all time but it has to be better if they go back to more **natural** methods…"* (BBC, 2013)

> *"I buy organic fruits and vegetables and milk and meat... I do it because I feel like it's a more **natural** way to be and, for some reason, that feels right."* (The Guardian, 2015)

These are all cases that connect the notion of what is natural with value. Using the terms *natural* and *unnatural* in this way can involve commending, praising, or favouring something on the basis of its being natural, or criticising, condemning, or disapproving of something on the grounds that it is unnatural.[2]

These examples of associations between naturalness and value are quite different to uses of the same terms which associate them with ideas about the countryside, rurality, forests, and greenery. Uses of the term *natural* described above are not the same as sentences like 'hedgehogs are a part of the UK's natural wildlife' or expressions such as 'natural variation' or 'natural sugars'. These are uses of the same words which do not clearly purport to make any statement about what is good or bad; they are better understood as meaning something akin to 'resulting from natural processes', 'found in nature', or 'brought about without human intervention'.[3]

It is worth noting that it is not always straightforward to distinguish uses of the terms *natural* and *unnatural* that invoke value from those which do not. Whilst some uses appear to be straightforward and value-free ('the natural sciences') and some seem to more clearly express a value judgment ('cloning is wrong because it is unnatural'), it is often not clear if a person means to say something positive or negative about the thing they describe using these terms.

These issues concern, in part, much broader questions within the philosophy of language, semantic content and linguistics. To some degree, they rely on both particular accounts of the semantic content – or meanings – of these terms, but also the mechanisms by which words and sentences manage to refer to, and mean, things.

Some views about the meanings of the words *natural* and *unnatural* will entail that it is never possible to use these terms without invoking value, since the appeal to

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[2] This need not involve making an 'all-things-considered' recommendation or condemnation, but does involve expressing some pro or con attitude towards the thing so described.

[3] There are other ways in which the word*natural* is deployed; *natural* can mean 'expected', 'common', or 'normal'. Such meanings can have normative force, though are not clearly ascribing the normative property of naturalness as it is invoked frequently in debates on bioethics topics.

value forms part of their semantic meaning.[4] Some may feel that they are semantically ambiguous and have (at least) two meanings: one which involves an evaluative component; and another which does not. Others may take the view that these words are not ambiguous, in the semantic sense, but that they can be (and often are) nevertheless deployed by language-users to denote things other than their semantic referents in order to invoke value.[5]

Understanding the way that the language of naturalness works may be more complex than determining the semantic content of these terms. It might be thought that, beyond the meanings of these words, the implications, suggestions, and associations that attach to their use in different contexts may mean that there are connotations of the terms *natural* and *unnatural* that sit outside their semantic content, but which are nevertheless important parts of what is conveyed when they are used. Denise Riley, the philosopher and poet, has argued, further, for an 'affect' in language that construes words as having the capacity to do, as well as refer to, things: "... *It's not just a matter of the unspoken "implications" of what's said, but something stronger... there is a tangible affect in language which stands somewhat apart from the expressive intentions of an individual speaker; so language can work outside of it official content."*[6]

Such ideas are clearly important for a complete understanding of how the idea of naturalness features in debates on science, technology, and medicine. Whilst the particular definitions of the terms *natural* and *unnatural* and the means by which they can convey notions of value, and carry meaning more broadly, are issues over which people may disagree, it is plausible that these words are used in everyday language in these two quite different ways. They may either convey something about the worth, desirability, or value of the thing described or denote some other more netural feature. It is the manner of using these words to communicate ideas about what is good and bad within debates on science, technology, and medicine that we have explored within this project.

The positive connotations of naturalness, and the terms *natural, unnatural,* and *nature* in debates about science, technology, and medicine has been remarked upon by scientists, philosophers, historians, and others. In her book *The moral authority of nature*, historian Lorraine Daston highlights the relevance of this issue for bioethics, arguing that the positive connotations of what is natural are "*easily established by following stories in the daily media on topics ranging from genetically manipulated organisms to surrogate motherhood...*"[7] Molecular biologist Lee Silver has said, "*Nearly every literate person perceives natural as a synonym for good, whereas the*

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4 This view receives some support from parts of the social sciences and from the idea, for example, that the 'natural' is a social construct. [*insert references*]

5 Perhaps, for example, in a way akin to that in which speaker-reference enables the use of terms to refer to things that do not form part of their semantic reference. See: Donnellan KS (1966) Reference and definite descriptions *The Philosophical Review* **75(3)**: 281-304.

6 Riley D (2005) *Impersonal passion: language as affect* (Durham, North Carolina: Duke University Press).

7 Daston L and Vidal F (2004) *The moral authority of nature* (Chicago: University of Chicago Press).

opposite idea – unnatural, artificial or synthetic – evokes a reflexive negative reaction."[8]

These notions are often associated with views that are deeply-held and can form the bases of profound and entrenched moral positions. Views about the natural can be very important to the people who hold them. Psychologist Paul Rozin, who has undertaken research into how people view the natural, observes that "*you don't argue with people about whether they believe in god or not and you don't try to tell people that natural isn't really good*".[9]

2.2 Different language used to express ideas about naturalness

Ideas about naturalness and the link between the natural and value are not expressed exclusively by use of the terms *natural* and *unnatural* and may be involved in, or inform, discussions of science, technology, and medicine in less obvious ways.

There are a large number of synonyms for the words *natural* and *unnatural*, many of which feature in discussions about bioethics and which sometimes convey ideas about value. The terms *normal*, *pure, real*, *authentic, organic, unadulterated, untouched, unprocessed* and numerous others are used in place of the term *natural*. The terms *artificial, contrived, designer, fake, abnormal, synthetic, manufactured, man-made, impure* and others can be used as a synonym for the term *unnatural*. Each of these words has slightly different connotations and some, with strongly disparaging or approving intrinsic associations, carry more positive or negative force than others.

For example, *pure, authentic, wholesome* and *proper* tend to be used to commend or praise within discussions of science, technology and medicine; words such as *fake, abnormal, impure,* and *freakish* are rarely used in a neutral way. *Freakish* does not simply mean 'statistically unusual', but instead carries implications of bizarreness, monstrosity and negative aesthetic features. Similarly, the word *fake* carries implications of pretence and deception and is plausibly only used to disparage.

> *"As a man, I can exclusively reveal that **fake** breasts are a giant turn-off for any red-blooded male."*(The Sun, 2013)
>
> *"**Fake** meat doesn't have the sexiest reputation amongfoodies*…" (The Daily Mail, 2012)

Similarly, the word *gentle* is sometimes used to describe things simultaneously described as natural in a range of contexts relating to the discussion of science, technology and medicine, where what is natural is associated with what is benign or mild. The concept of gentleness is inherently positive and conveys ideas about mildness, softness, and low risk of harm; it has associations with distinctly human qualities, such as kindness.

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[8] Ball P (2012) *Unnatural: the heretical idea of making people* (London: Vintage).

[9] The Guardian (6 August 2013) *Synthetic meat: is it 'natural' food?*, available at: http://www.theguardian.com/lifeandstyle/wordofmouth/2013/aug/06/synthetic-meat-natural-food-google-burger.

> *"These days, we can work wonders by skilful use of Botox and fillers to lift, nip and tuck in a much **gentler**, and more **natural** way."* (The Telegraph, 2015)

> *"The early results in 30 women show kisspeptin can be used to stimulate egg release in a **gentler**, more **natural** way."* (BBC, 2013)

Conversely, terms like *artificial* and *synthetic* appear to have fewer evaluative associations and are, at least sometimes, used in ways which appear more neutral. These terms can be used quite impartially in public discussions of science, technology, and medicine to refer to scientific or engineered products, and are used regularly within science to refer to processes, materials, compounds, and other entities:

> *"'Scientists use skin cells to create **artificial** sperm and eggs'... Over the five day process, the scientists added natural chemicals called growth factors to nudge the cells in the right developmental direction."* (The Guardian, 2014)

> *"For example, nanotechnology could fill them with **synthetic** platelets, the naturally occurring cell fragments vital for clotting, enabling wounds to heal faster…"* (The Daily Mail, 2013)

However these terms can also be used in quite provocative ways and the positive or negative force which these words have depends on the context within which they are used and the thing to which they are applied. For example, the following examples do not seem to be entirely value-neutral:

> *"Most of the 600 people working at Thanet Earth appear to believe passionately in what they do, and angrily reject the charge that they are somehow perverting nature or creating something **artificial**."* (The Telegraph, 2013)

> *"Natural beauty trumps **artificial** beauty in the hierarchy, but it is a fact that you cannot look the same for ever without having something done."* (The Daily Mail, 2013)

The extent to which ideas about value are conveyed with the use of a particular term depends on the situation and particularly the thing to which the term is applied. Designer sunglasses may be desirable, but a designer baby may not be. Similarly, referring to prosthetics as 'synthetic limbs' may be less provocative than talk of 'synthetic children'. Discussions of science, technology, and medicine therefore sometimes associate naturalness with value in ways that are not immediately obvious.

The way that these terms are deployed in discussion of novel science, technology, and medicine, and the particular language used, is important since the connotations of a particular word can convey messages about the acceptability of novel science, technology and medicine.

2.3 *Natural* versus *unnatural*

Our work identified an asymmetry between use of the terms *natural* and *unnatural*. It found that, proportionately, there is a contrast between the regularity with which value is invoked by use of the term *natural* and the term *unnatural* (see Figure 1). Within the sources reviewed, the term *natural* was used much more commonly than the term *unnatural* and was typically used in a value-neutral way. In contrast, when the term *unnatural* was used, it was often used to suggest something is wrong or bad.

The term *natural* appears to have a wide range of uses in value-neutral contexts, such as '*natural selection'* and *'natural variation'*. Most of the examples were of the following kind:

> *"The [GM] rice has been engineered so that the precursor chemical is expressed in the edible grain as well as in the non-edible leaves, where it occurs* ***naturally***." (BBC, 2013)

Uses of *natural* which invoke value, such as the following, therefore formed a lower proportion overall of these uses:

> *"I don't have any concerns about stem cells – they aren't man-made like Botox. I feel reassured about the safety because it is a* ***natural*** *product."* (The Sun, 2013)

In contrast, the majority of uses of the term *unnatural* were value-laden, or were borderline cases, and a notably smaller proportion of uses were value-neutral. *Unnatural*, as compared with *natural,* seemed to be more reliably associated with value in discussions of science, technology, and medicine.

> *We'd assumed IVF was a magic bullet, where the only major concern was coming to terms with making a baby in a rather* ***unnatural*** *way.* (The Daily Mail, 2014)

> *The instinctive desire within many of us not to consume something that is "****unnatural****" – the fear of so-called "****Frankenfoods****"*. (The Guardian, 2012)

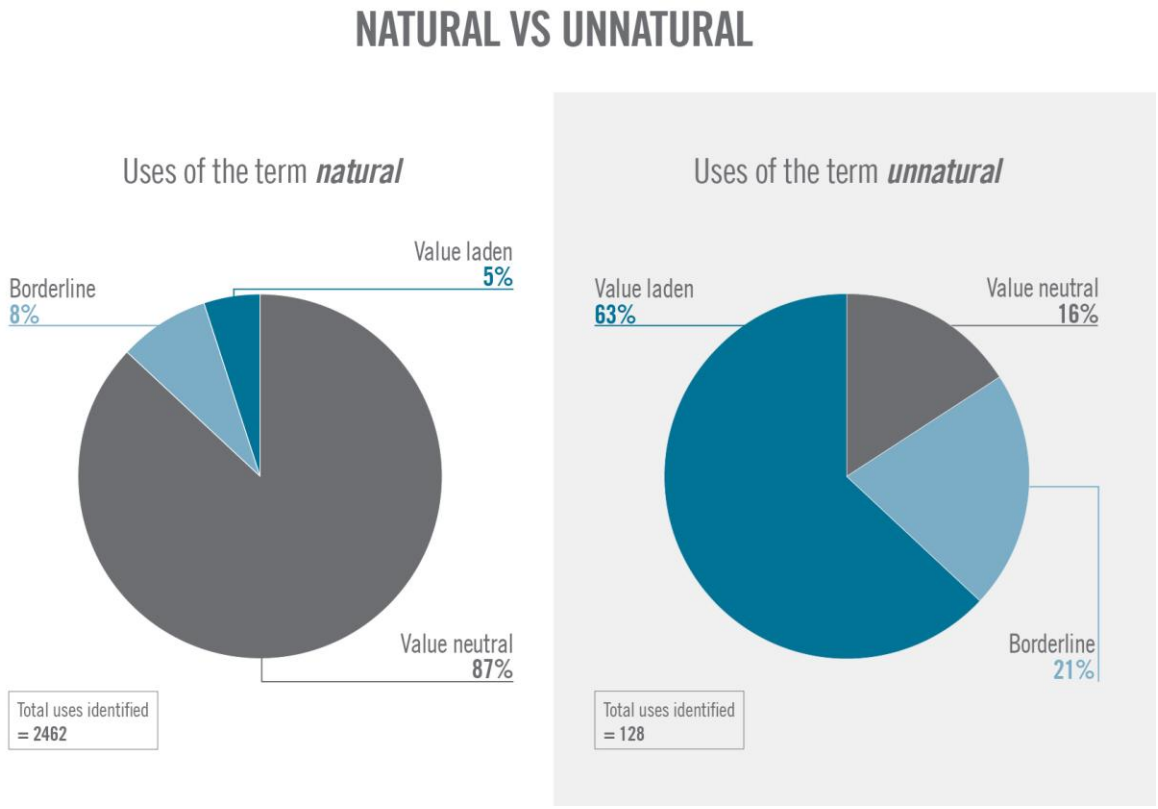
> *I was also unhappy with the idea of having something as* ***unnatural*** *as a* ***silicone implant*** *in my body.* (The Daily Mail, 2012)

This may indicate something about the intrinsic associations of the two words. The historian Helmut Puff, for example, has made the following observation about terms that begin with the prefix 'un' and also offers an explanation as to why the term *unnatural* appears to have negative associations:

> *"Un-natural is not simply non-natural, the opposite of natural. By sheer weight of the rhetorical tradition and frequent usage in moralizing contexts, 'un-' words take on additional connotations, the other side of the norm*. *From the point of view of the speaker, 'un-natural' articulates a polemical stance. 'Un'-ennunciations condemn*

that which is expressed, declare it as dangerous, treacherous ground… it is a word that polices the dangerous boundary between the normative and non-normative, the pure and the impure."[10]

Figure 1: Comparison of different kinds of use of the terms natural and unnatural identified in media articles, Parliamentary debates, and the reports of civil society and science organisations



2.4 The challenge of distinguishing between the natural and unnatural

Associating what is natural with what is good, and what is unnatural with what is bad, is not straightforward. One reason for this is that there are difficulties in drawing any sharp line between what is natural and what is unnatural.

For example, one candidate for an account of the difference between the natural and the unnatural is that natural things are those 'found in nature'. If we think of nature as the entirety of the natural or physical world then this definition of *natural* does not seem able to effectively capture the difference between what we think of as natural and unnatural. Synthetic polymers, particle accelerators, and robots are no less part

[10] Puff H (2004) Nature on trial: acts 'against nature' in the law courts of early Modern Germany and Switzerland, in *The moral authority of nature*, Dalston L, and Vidal F (Editors) (Chicago: University of Chicago Press).

of the physical world than wild deer or waterfalls. This account of what is natural is too broad, since it includes many of the things that we might be inclined to characterise as unnatural. If, conversely, our view of nature is constrained to include only that which can be found in the countryside or in rural areas, then many things we might think it would be odd to describe as unnatural – such as bicycles or reading glasses – will turn out to be unnatural, suggesting that the definition excludes too' much.

Natural processes might instead be perceived as those that happen, or could happen, without human intervention. This would account for the naturalness of processes like photosynthesis, pollination, animal reproduction, ageing, and death. But in that case lots of uncontroversial human activities that could not happen without human intervention, such as cooking or writing poems, will turn out to be unnatural. And certain processes of direct relevance to debates on science, technology, and medicine that are construed to fall on the *natural* side of the division, such as natural reproduction and natural conception, will not meet these criteria, meaning that this definition again is too broad.

Making a principled contrast between those things that appear natural to us, and those which do not, is therefore not simple. For some, this casts doubt on the idea that any such division might be used to separate ethically acceptable from ethically problematic technologies.

Claims about the significance of naturalness of the kind commonly made in public debates, taken literally, can seem arbitrary or unreasoned, and straightforward appeals to nature are sometimes rejected out of hand by bioethicists. For example, in discussing objections to the use of assisted reproduction techniques, the appeal to naturalness is given short shrift by bioethicist John Harris, who suggests that the many unnatural interventions that make up modern medicine are widely considered to be a good and valuable feature of human activity:

> "... *The argument from what is or is not natural need not detain us long. Since the whole practice of medicine is unnatural (people naturally fall ill and die prematurely), if we were to accept an ethic which required us not to interfere with what was natural there would be little for medical practitioners and medical scientists to do."*[11]

The parallel point – that there are many aspects of nature which are bad – is made by philosopher Frances Kamm in response to the idea that naturalness "is sacred and should be honored":[12]

> *"… But why should we believe this? Cancer cells, AIDS, tornadoes, and poisons are all parts of nature. Are they sacred and to be honored? The natural and the good are distinct conceptual*

[11] Harris J and Holm S (2000) *The future of human reproduction: ethics, choice and regulation* (Oxford: Oxford University Press).

[12] Which comes from Michael Sandel's influential discussion of 'giftedness' in debates about the use of science, technology for human enhancement. See:Sandel M (2009) *The case against perfection* (Cambridge, MA: Harvard University Press).

categories and the two can diverge: the natural can fail to be good and the good can be unnatural."[13,14]

Bioethicist Guido de Wert describes the challenge of distinguishing the natural from the unnatural in such a way that can support the use of this distinction to guide decisions about the ethics of novel science, technology, and medicine:

> *"Some people consider reproductive technologies to be morally wrong because they are 'unnatural'... The argument that 'x is wrong because it is unnatural' can only succeed if there is an interpretation of the term 'unnatural' which enables us both to distinguish clearly between natural and unnatural actions, and to understand what there is about the latter which is morally objectionable. It is doubtful whether there are any such interpretations which are convincing or even plausible..."*[15]

2.5 Different meanings to different people

Observations of the kind made above are important insofar as they caution against any casual adoption of blanket oppositions to novel technologies. They expose the difficulties in drawing sharp lines between what is natural and what is unnatural, which suggest we should be wary of using these concepts unreflectively to sort new technologies into two categories: those which are morally acceptable; and those which are morally unacceptable.

However, these positions, baldly stated, are not fully sensitive to the variety of ideas, assumptions, and associations which different people have and make about what is natural and unnatural.

Work by psychologists and cultural historians indicates that there is not just one conception of the natural, and that ideas about nature are layered and multidimensional. Fiona Coyle and John Fairweather describe the concept as a

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[13] Kamm FM (2005) Is there a problem with enhancement? *The American Journal of Bioethics* **5(3)**: 5-14. The observation that there are many aspects of nature that are not good is one that is conceded even by some whose views are construed as anti-enhancement.

[14] The observation that many aspects of nature are bad, or give rise to 'bad effects', is even conceded by those whose views on the use of science and technology are widely construed as conservative. In the Council's 2012 review of novel techniques for the prevention of mitochondrial DNA disorders, it was observed that: "Even Leon Kass, the former chair of the US President's Council for Bioethics, who is noted for his appeals to the 'wisdom of repugnance' in the domain of reproductive ethics, has pointed out that the mere fact that some process is natural, and in this sense a 'gift', leaves open the question of "which gifts are to be accepted as is, which are to be improved through use of training, which are to be housebroken through self-command or medication and which opposed like the plague."" See: Nuffield Council on Bioethics (2012) *Novel techniques for the prevention of mitochondrial DNA disorders: an ethical review*, available at: http://nuffieldbioethics.org/wp-content/uploads/2014/06/Novel_techniques_for_the_prevention_of_mitochondrial_DNA_disorders_compressed.pdf, at paragraph 4.47.

[15] de Wert G (2000) The post-menopause: playground for reproductive technology? Some ethical reflections, in *The future of human reproduction: choice and regulation*, Harris J, and Holm S (Editors) (Oxford: Clarendon Press).

"*fluid, contested, material-semiotic construction, historically and spatially grounded*."[16] In work exploring public attitudes they note:

> "*The term nature is one of the most complex words in the English language and it has been personified, romanticized, essentialized, abstracted and materialised...*"[17]

Their 2005 study exploring differences in how people view nature and biotechnology mapped these views onto five distinct 'chronotypes' – wise nature, traditional nature, pure nature, complex nature, and balanced nature – each of which has a different set of underlying connotations and associations.

Wise nature, according to this view, is perceived as inherently good, whole, and perfect. It often involves trust in the 'wisdom of nature' and is used as a moral lens through which to appraise the acceptability of novel technologies.

> *"In the chronotope of wise nature, we saw the personification of a nature as "Mother Earth," "Gaia" or "the healer". Moreover, embedded within this personification was an assumption of moral goodness, with wise nature being a moral framework from which participants compared any changes that might occur over time and space. Ultimately, wise nature was anthropogenic..."*[18]

Complex nature overlaps significantly with the notion of wise nature and features ideas of fluidity and change.

> *"Nature was viewed by some participants as a process, characterized by dynamism, complexity, transience and evolution… nature was alive, an actor and, moreover, a protagonist in its own development. Furthermore, this feisty actor could not be directed through human intervention."*

Nature is also sometimes seen as essentially pure; a source of things that are benign, wholesome, healthy, and safe. On this construction, nature is something that should be sanctified, revered and that is untainted by the interventions of human beings. It also:

> *"…corresponds closely to the concept of nature as wilderness, lying "out there," in other places, as the "antidote for the poisons of industrial society" (Schama, 1995: 7). This is nature in a realist sense, devoid of human interference."*[19]

Other ideas connect nature with tradition and a slower pace of life or with the notion of balance and harmony, that can be disrupted by people's 'unnatural' interference.

> *"This was perceived as a nature of time-past and reminiscence for what once was: a slower pace of life that was stress free. In this*

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16 Coyle F and Fairweather J (2005) Space, time and nature: exploring the public reception of biotechnology in New Zealand *Public Understanding of Science* **14(2)**: 143-61.

17 Ibid .

18 Ibid .

19 Ibid , citing Schama S (1995) *Landscape and Memory* (Toronto: Random House).

> *pastoral idyll, time was not reversible, but interestingly was slowed down almost to a halt."*[20]

Other perspectives on nature and the source of its perceived value come from the idea of age, endurance, and antiquity. Historian Donald Worster has described nature as a "*creative work that has been going on for billions of years*",[21] a view echoed in the work of biologist David Ehrenfeld who has argued that we should see the conservation of nature as important since the existence of species and other biotic communities "*is itself but the present expression of a continuing historical process of immense antiquity and majesty"* .[22]

In addition to the many different ways of conceptualising nature as a positive force, nature has also been construed as vengeful, powerful and dangerous. Coyle and Fairweather report that nature is seen by some as a "*fighter*" or "*warrior*". In Phil Macnaghten's work exploring public perspectives on nature within the context of the genetic modification of animals, he reports that among some research participants there was:

> *"... The lurking sense that such interventions appeared to violate a deontological sense of 'nature', and that such a nature had a tendency to 'fight back' in vengeance."*[23]

This is something which, according to the philosopher Bernard Williams, is reflected in people's attitudes towards nature. He notes: *"human beings have two basic kinds of emotional relations to nature: gratitude and a sense of peace, on the one hand, terror and stimulation on the other*."[24]

The difference between the idea of nature as vengeful and dangerous, and conceptions which construe nature as, in different ways, positive, also manifests in philosophical ideas about nature. Quite different notions of nature, for example, are reflected in the political philosophy of Thomas Hobbes and Jean-Jacques Rousseau.

Hobbes' notion of the 'state of nature' bears little resemblance to the benign, peaceful, balanced picture that characterises contemporary conceptualisations of the natural environment, nor the idea of the pure, undeveloped nature sometimes contrasted with the contaminated civilisation of today. Hobbes' view is that nature is a fundamentally disordered, chaotic, and dangerous state, upon which human beings have good reason to organise and impose (political) structure onto, even if this means sacrificing one's freedom and submitting to a sovereign. This natural state of being for humankind was not something to be valued, preserved, or respected but rather provided an environment within which people would experience

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20 Ibid .

21 Worster D (1993) *The wealth of nature: environmental history and the ecological imagination* (Oxford: Oxford University Press).

22 Ehrenfeld DW (1978) *The arrogance of humanism* (New York: Oxford University Press).

23 Macnaghten P (2004) Animals in their nature a case study on public attitudes to animals, genetic modification and 'nature' *Sociology* **38(3)**: 533-51.

24 Williams B (1995) Must a concern for the environment be centred on human beings?, in *Making sense of humanity and other philosophical papers*, Williams B (Editor) (Cambridge: Cambridge University Press).

"continual fear and danger of violent death" and life for people would be *"poor, nasty, brutish, and short."*[25]

Conversely, Rousseau provides a very different conception of nature and the natural. Rousseau's work emphasises the negative aspects of society and the corrupting influence of social living, commending the existence of the 'noble savage' who, in man's pure, natural state, is *"untainted by the degradations of civilised life, a magnificent innocent."*[26]

The same tension between the notion of nature as, on the one hand, pure and untarnished, and, on the other, primitive and chaotic is also visible within discussions of naturalness as it relates directly to particular bioethics issues. For example, a parallel distinction is made within a discussion of cosmetic enhancement, beauty, and ageing.[27]

> *"The concept of natural has been a source of contentious debate as theorists posit and refute the binary opposition of nature and culture. One view of the natural body is that of a pre-cultural body, or a pre-existing entity free of cultural pressures and influences. According to this perspective, nature is a pure and original condition that is desirable, necessitates no explanation, and defies historical change. Alternatively, some theorists suggest that culture is privileged over nature, and human/patriarchal existence constitutes a struggle against the primordial and diminishing forces of nature."*[28]

For these reasons, dismissing outright objections made to 'unnatural' science, technology, and medicine does not acknowledge the set of more complex ideas that often underlie criticisms deploying the concept of naturalness. Ignoring such associations also fails to acknowledge the sometimes deeply-held moral views with which these ideas can be connected. These ideas can have a significant impact on how innovative science is perceived and may feed into how likely novel technologies are to be accepted or rejected by the public.

These associations may also be hard to recognise and identify. For some people, concerns about novel science, technology, and medicine may be manifestations of anxieties, hopes, and fears, the character of which may be hard to pinpoint. We may find novel technologies unsettling or disturbing, or be drawn to natural products or

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25 Hobbes T (1651) *Leviathan*. Hobbes was evidently interested in establishing more than just a picture of nature, and with Leviathan aimed to explore and establish the moral basis for the authority of the state, amongst much else.

26 Coward R (1989) *The whole truth: myth of alternative health* (London: Faber & Faber).

27 It is worth noting that the term *natural* features less prominently in the literature on cosmetic enhancement, where discussion of *normalness* is more common. See, for example, Parker R (2010) *Women, doctors and cosmetic surgery: negotiating the 'normal' body* (Basingstoke: Palgrave Macmillan); Kisler TS (2011) *Am I normal? Challenging the promotion of female genital cosmetic surgery* (September 2011: College of Human Science and Services Diversity Day; University of Rhode Island).

28 Hurd Clarke L and Griffin M (2007) The body natural and the body unnatural: beauty work and aging *Journal of Aging Studies* **21(3)**: 187-201.

techniques, in ways that are difficult to describe or hard to fully explain, even when these ideas are our own.

According to this view, the positive and negative claims people make that appeal to naturalness may function as *placeholders* for a wide range of other concerns and values. The concept of naturalness may be viewed as a repository for these different and varied ideas. Therefore, instead of underlying views (about science, technology and medicine and their relationship to health, food, reproduction and recreation), ideas about naturalness may sit atop a deeper, unarticulated sense of unsease or disapproval. On either view, the positive and negative associations people make with naturalness can be strongly felt and important, and warrant further exploration.

It is important therefore to engage with these ideas and probe what positive or negative features, precisely, are being appealed to when people associate naturalness with value. Our own work exploring ideas about naturalness in media, Parliamentary, civil society, and science sources exposed a range of meanings and associations that connect with these different perspectives, which are discussed in depth at section 4 below.

2.6 Changes to meaning over time

Views about what is natural and unnatural change over time. Technologies in science and medicine that were once seen as unnatural can come to be regarded as natural as time passes and as people become accustomed to the use of new technologies and techniques.

This means that the kinds of things to which people are disposed to object to or approve on the basis of naturalness can change with the passage of time too. This is a point that former UK Prime Minister Tony Blair made in an address to the Royal Society in 2002; he argues that there is reason to be cautious of concerns about unnatural technologies since perceptions about what counts as unnatural change with time.

> *"There were riots in the streets when the smallpox vaccine was introduced. Smallpox has now been eliminated. In the early days of heart transplants they were attacked as unnatural or dehumanising, but in surveys today heart transplants are seen as one of the most beneficial results of modern science."*[29]

Our own work exploring how ideas about naturalness inform public debate examined material from the last 15 years and therefore reflects a relatively contemporary perspective on the things that tend to be described as natural and unnatural today. Looking at examples of debates conducted in the more distant past presents insight into these changes and helps to expose how the terms *natural* and *unnatural* were used differently in the past.

Some of the clearest examples come from an area now widely considered to be outside the boundaries of bioethics, at least within western critical perspectives.

[29] The International Service for the Acquisition of Agri-biotech Applications (2002) *Full text of Tony Blair's speech on British science: Royal Society, 23 May*, available at: https://www.isaaa.org/kc/Publications/htm/articles/Position/speechfull.htm.

Questions relating to sexual orientation are no longer treated as issues of applied ethics within the majority of mainstream English-speaking media and politics (but was once considered to be a treatable medical illness.[30] Homosexuality is widely accepted by the general public within the UK[31] and is not largely considered to present substantive moral questions, either in academic contexts, or within public debate.

However, decades previously, homosexuality was considered to be a live bioethical topic, on which people openly expressed strong moral views in public fora. Objections were frequently based upon appeal to the idea of biological or natural purpose and invoked ideas about what is natural in order to attempt to substantiate claims that certain lifestyles are morally wrong. Some of the language used in one of the 1988 Parliamentary debates on the prohibition on promoting homosexuality by teaching or publishing material, which describe it as an *"unnatural perversion*" of *"human function"* conveys this very effectively. Media articles from this period in the 1980s also sometimes suggested that the 'unnaturalness' of homosexuality was linked to issues around HIV and AIDS. The Sunday Times in 1989 quoted the views of the Conservative Family Campaign (a civil society organisation): *"it is the homosexual network which is at most risk because of the unnatural practices they indulge in."*[32]

A separate point concerns the stability of the concept of nature itself. That is, the very meaning of the word *nature* and the concept to which it corresponds may be malleable and change in significant, qualitative ways. This would mean that in addition to shifts in our ideas about what it is correct to call or classify as natural and unnatural, our very concept of nature itself may change over time.

The prevailing concept of nature within a given period may be sensitive to a range of social and political factors; the wider social context in which ideas about nature evolve is likely to be a key factor in how people conceptualise the natural. Macnaghten and Urry argue that religious belief was a key factor in pre-Enlightenment views, which construed God and nature as very closely connected.[33]

The impact of the Enlightenment and also the influence of the Newtonian perspective of the world as, at root, deterministic, fundamentally changed the way people viewed the natural. Coyle and Fairweather articulate the ways that perspectives on nature and religious belief came apart in this period:

> *"The sixteenth and seventeenth centuries bore witness to the separation and abstraction of nature, from a life-giving force to dead matter; from spirit to machine. During this period God became*

[30] But was oncehttp://www.hollandandbarrett.com/shop/product/bootea-teatox-60035242 widely considered to be a treatable, medical illness presenting distinctive issues within medical ethics.

[31] However, the Pew Research Centre's Global Attitudes Survey of 2013 indicated that 76% of people in the UK believed that homosexuality should be accepted by society, leaving a substantial minority reporting believing the opposite. Nevertheless the prominence of debate about the morality of such homosexuality, or its naturalness, is not common in mainstream media and political debate.

[32] The Sunday Times (19 November 1989) *Fears versus the facts*.

[33] Macnaghten P and Urry J (1998) *Contested natures* (London: Sage).

> *detached from a nature that was reduced to a series of laws, products and conventions – a clockwork universe."*[34]

As historian Ludmilla Jordanova has observed, changes in perspectives on nature are reflected in a range of fields and *"works on political economy, social theory, moral and natural philosophy, domesticity, aesthetics and religion all bear the imprint of profound shifts in how nature was understood."*[35]

In work exploring how the concept manifests in literature, for example, Anthony Pilkington has argued that the concept of nature changed significantly between the 17th and 18th Centuries, particularly in how nature and value were taken to relate to one another: *"nature was put to work throughout the eighteenth century in a normative way both in aesthetics... and in ethics, where nature was appealed to in various sense as an ethical norm."*[36] Exploring how perceptions about the connection between nature and ethics changed over the course of the 18th Century, Pilkington explains that, in the early 1700s, nature was used as a positive norm in the sense that *"virtue is held to be natural to man"* and nature supplies a *"harmonious connection between morality and happiness"*. He notes that, by the end of the century, *"a new use of the idea of nature emerges"* which can be observed in the work of Diderot, D'Holbach and Laclos in which it is seen as *"ethically neutral and blindly amoral"*.[37]

In the context of bioethics, changes to how the natural is seen over time can also be observed. In a discussion of medicine and birth, for example, the philosopher Steen Wackerhausen observes that *"the concept 'natural' is highly used and plays a prominent role"*. This, he suggests, largely conforms to the view of natural as having *"positive emotional conten*t". He notes, however, that the artificial, within medicine, was formerly viewed in a much more positive light:

> *"However, it has not always been that way: going back to the 1950s and the 1960s, we find that the term 'artificial' was, at least to many, a term with positive connotations, a term evocative of progress, welfare and optimism. In contrast, 'natural' was, at least partly, a conservative term. What was natural was the world of yesterday, the world of poverty, starvation and deadly diseases."*[38]

Coyle and Fairweather also note the temporal aspects to perspectives on the natural, suggesting that the history of the notion is so complex that it undermines the idea that there is any one 'nature' at all:

> *"Indeed, as it has a diverse and contested history that spans numerous lifetimes, many researchers prefer to use the term*

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34 Coyle F and Fairweather J (2005) Space, time and nature: exploring the public reception of biotechnology in New Zealand *Public Understanding of Science* **14(2)**: 143-61.

35 Jordanova LJ (1986) Introduction, in *Languages of nature: critical essasy on science as literature*, Jordanova LJ (Editor) (London: Free Association Books).

36 Pilkington AE (1986) "Nature" as ethical norm in the Enlightenment in *Languages of nature: critical essays on science as literature*, Jordanova LJ (Editor) (London: Free Association Books).

37 Ibid .

38 Wackerhausen S (1999) What is natural? Deciding what to do and not to do in medicine and health care *BJOG: An International Journal of Obstetrics & Gynaecology* **106(11)**: 1109-12.

> *"natures" for it is impossible to reduce this history to one harmonious definition."*[39]

2.7 Speaking at cross-purposes

The diversity of views about the natural which vary amongst individuals, societies and over time, have prompted some to adopt a sceptical view of the objectivity of judgments about nature. The sociologist Adrian Franklin has observed that:

> *"Nature is not for us a concrete reality that may be like this or like that, but an idea or series of ideas which specific people (in specific times and places) use to frame and understand their world."*[40]

These distinct conceptions, relating to different temporal, cultural, and individual perspectives, suggest that people see the natural in very different ways. They will not always agree with one another about what counts as natural and whether the natural is good. When they agree that the natural *is* good, they will not necessarily construe what is valuable about nature and naturalness in the same way.

Sociologists Phil Macnaghten and John Urry note this, and suggest that the diversity of views about naturalness has ramifications for those who use judgments about what is natural and unnatural to guide moral decision making.

> *"Nature does not simply provide an objective ethics which tells us what to do. It is too ambivalent, contested and culturally paradoxical for that."*[41]

This diversity of meaning raises a question about how effectively people communicate with one another when using these terms. Particularly, these diverse meanings suggest that people who use these terms may be speaking at cross-purposes, or 'talking past' one another – using identical terms with different meanings and thereby failing to understand one another – when deploying these words within debates about the ethics of science, technology, and medicine. Other possible reasons to ascribe to this view, alongside its implications, are discussed in more depth in our assessment of accounts of naturalness in section 4 below.

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39 Coyle F and Fairweather J (2005) Space, time and nature: exploring the public reception of biotechnology in New Zealand *Public Understanding of Science* **14(2)**: 143-61.

40 Franklin A (2002) *Nature and social theory* (London: Sage).

41 Macnaghten P and Urry J (1998) *Contested natures* (London: Sage).

3. The role of naturalness in debates about science, technology and medicine

Section summary

- Ideas about naturalness feature in public discussions of a wide range of topics in science, technology and medicine.
- There are examples of uses of the terms *natural, unnatural* and *nature* which connect naturalness with value in media, Parliamentary and civil society sources and in the commercial retail sector.
- The overall proportion of uses of the terms *natural, unnatural* and *nature,* in all sources, which connect naturalness with value, was low.
- In the publications of organisations representing scientists, uses of the terms *natural, unnatural* and *nature* that connected naturalness with value were rare
- In media articles, uses of the terms *natural, unnatural* and *nature* were more regularly connected with value in non-news, as compared with news, articles.
- In the work of civil society organisations, there was a lower proportion of uses of the terms *natural, unnatural* and *nature* that challenged or questioned the link between naturalness and value.
- In the commercial retail sector, there are differences in how use of the term *natural* in marketing material is regulated for different products, and consumer research suggests that people are confused by its use in some retail contexts.

3.1 Introduction

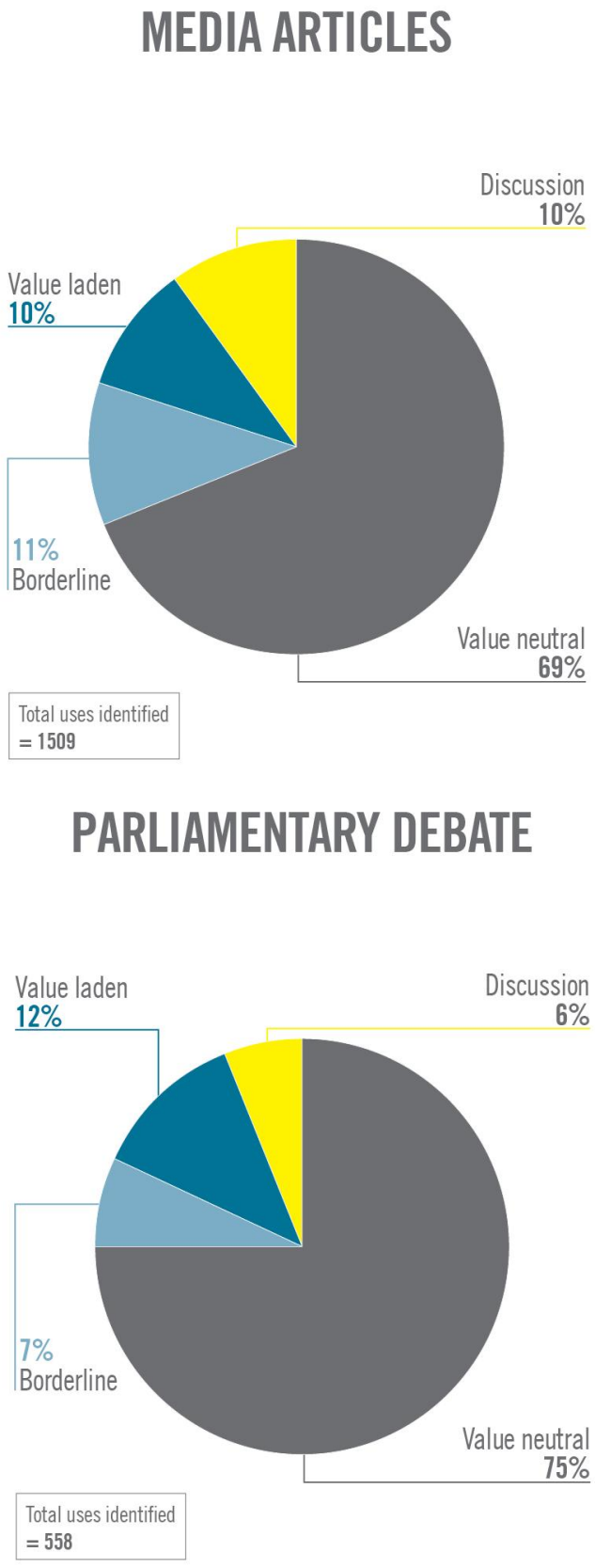
Our review explored use of the terms *natural*, *unnatural* and *nature* within media, political, civil society and science organisations' discussions of science, technology and medicine. It identified features of how these terms are deployed and explored differences in how they can be used in different contexts. Material relevant to a range of bioethics topics was examined and uses of the terms *natural*, *unnatural* and *nature* sorted into one of four different categories: value-laden, value-neutral, borderline cases and discussion uses. A full account of the approach and methodology for the review has been published separately.[42]

The review identified examples of value-laden uses of all terms across media, Parliamentary and civil society sources. We also found a number of examples of this kind in the labelling and promotion of goods in the commercial sector. However, there were very few value-laden uses in the publication of organisations representing scientists (see section 3.5 for further discussion). The overall proportion of uses of value-laden and borderline uses of all terms, *natural, unnatural* and *nature,* when taken together, was low (see Figure 2).

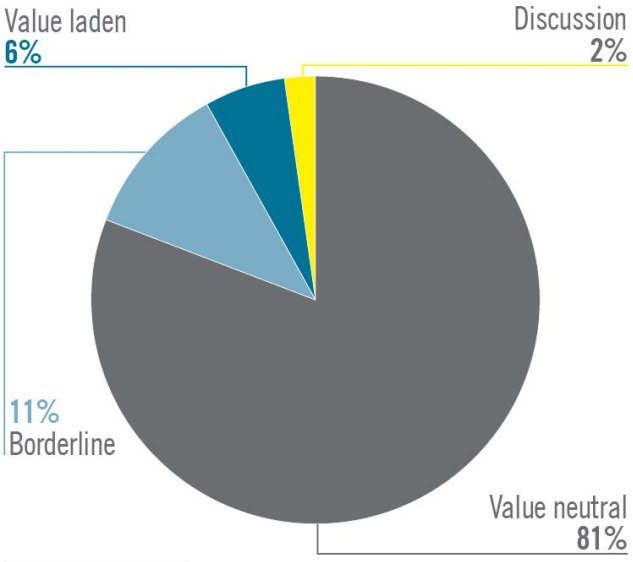
The following sections report our findings on how different ideas about naturalness feature in public discussions of the ethics of science, technology and medicine.

[42] Nuffield Council on Bioethics (2015) *Review of media, Parliamentary, civil society and science sources*, available at: http://nuffieldbioethics.org/project/naturalness/evidence-gathering/

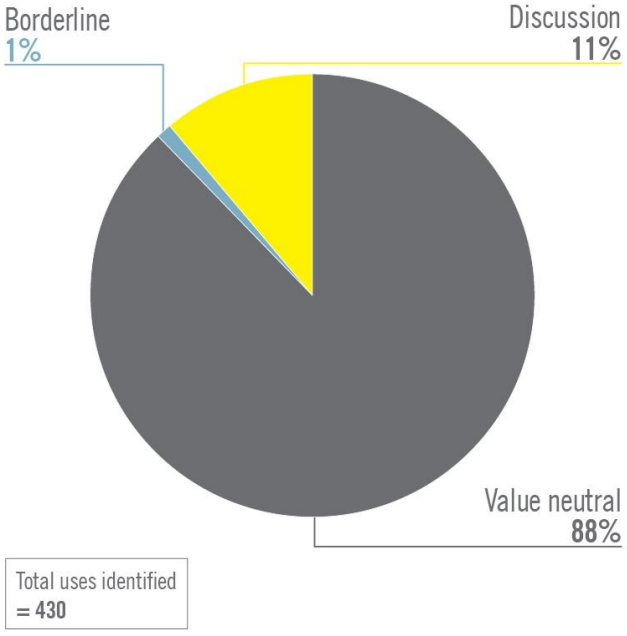
Figure 2: comparison of different kinds of use of all terms (*natural, unnatural* and *nature*) identified in media articles, Parliamentary debate and the reports of civil society and science organisations



CIVIL SOCIETY ORGANISATIONS



SCIENCE ORGANISATIONS



3.2 Media

Ideas about naturalness are often prominent in discussions of novel science, technology, and medicine in the media. The media can exercise a powerful influence over public perceptions of novel technologies. It has been argued, for example, that public trust concerning genetically modified crops has been undermined by aspects of media coverage on the topic, alongside a perceived failure of the scientific community to take public concerns seriously, contributing to ongoing resistance.[43] Given such concerns, we thought it was important to further explore how the media represents ideas of naturalness within debate on science, technology, and medicine.

In newspaper and online news articles, both of which typically involve shorter, less involved discussion of topics, describing something as *natural* can be a succinct way of suggesting that a medical treatment is less invasive or that a food is 'better for you'. Similarly, describing something as *unnatural* can be a concise way of capturing a range of complex ideas and concerns about novel technologies and can tap into preconceptions, biases, and anxieties held by some people about scientific change.

> *"… There is no evidence that manufacturers are using greater quantities of the real,* ***natural*** *ingredients consumers want."* (The Guardian, 2015)

> *"In Britain and the EU it is still illegal to sell meat or milk from cloned animals for food in general – and surveys suggest that consumers would most strongly object to eating or drinking such* ***unnatural*** *products."* (The Daily Mail, 2010)

Some of the language used to discuss novel technologies in ways that invoke ideas about naturalness appears to be distinctive to particular sections of the media. Discussion of 'frankenfoods', for example, happens rarely outside parts of the press and, similarly, expressions such as 'designer babies' or 'three-parent children' are infrequently used in non-media contexts.

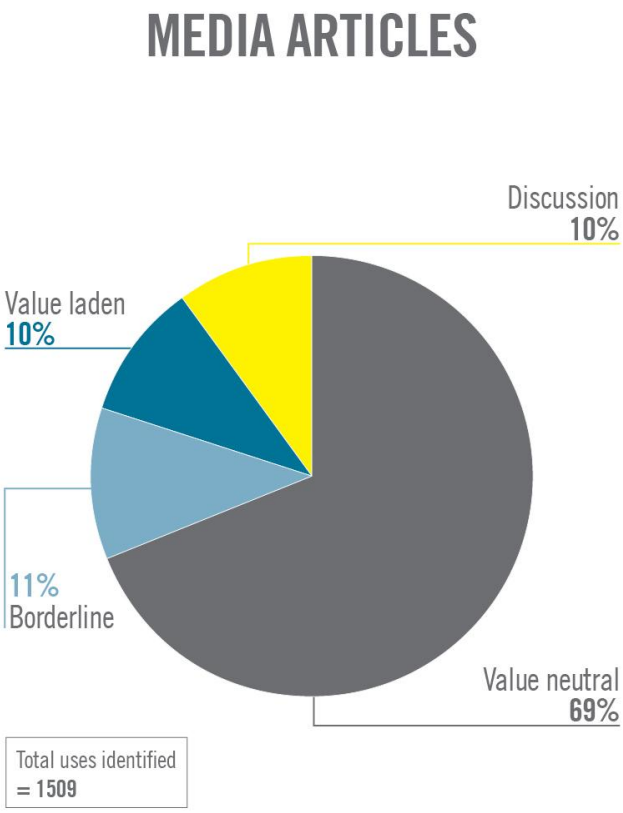
> *"It will be the same story with this new* ***Frankenburger****. Its transfer yesterday from the laboratory to a London dining table is no cause for celebration. On the contrary, it is a move towards the greater industrialisation of the food chain rather than towards a deeper embrace of the richness nature has to offer."* (The Daily Mail, 2013)

> *"Lucy's story is part of a wider debate over sperm banks and "designer babies". It's selfish and* ***unnatural****, say the critics. It's treating babies like puppies and handbags. It's playing God. It's devastating for the child."* (The Telegraph, 2014)

[43] See, for example, Marchant R (2001) From the test tube to the table. Public perception of GM crops and how to overcome the public mistrust of biotechnology in food production *EMBO reports* **2(5)**: 354-7.

Whilst the proportion of value-laden uses of the words *natural*, *unnatural* and *nature* in the media was overall quite low, and similar to the proportion in Parliamentary and civil society sources (see Figure 3), this work exposed a difference in how these terms were used within media sources, when comparing news and non-news articles.[44]

Figure 3: Different kinds of use of all terms (*natural, unnatural* and *nature*) identified in media articles from 2010-5.

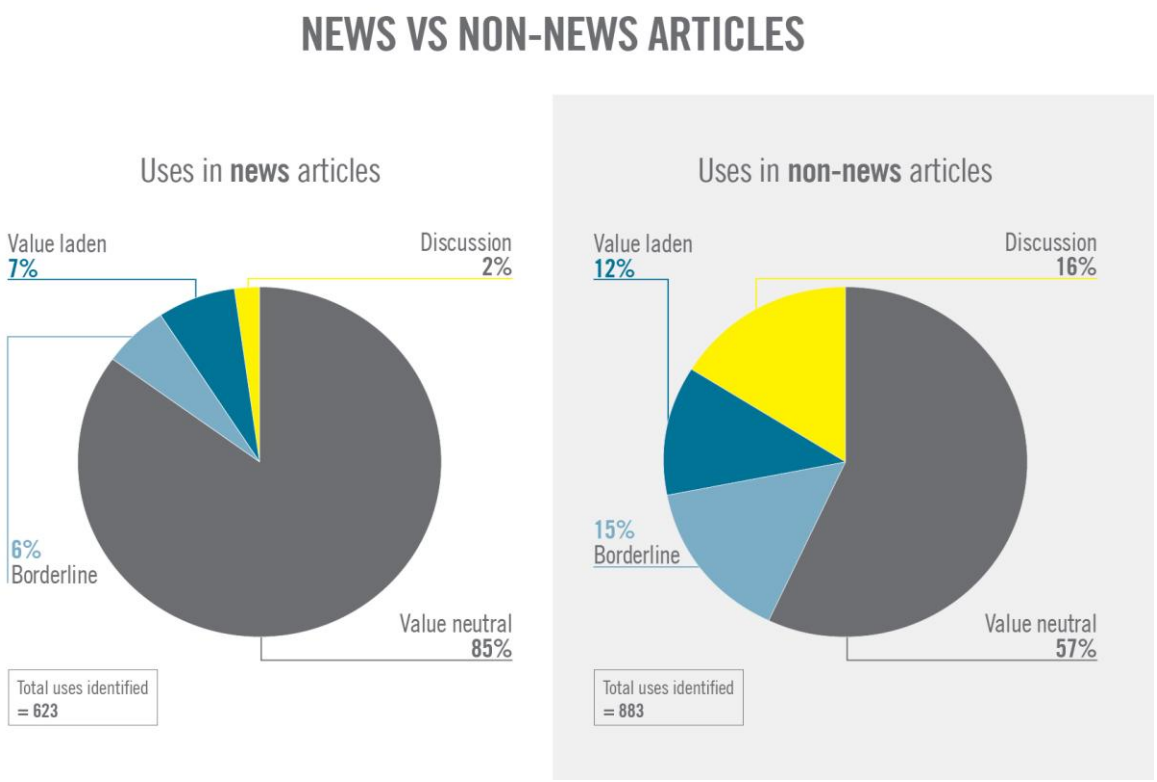


The pie charts below (see Figure 4) compare use of the words in these two different sorts of article and show a noticeably larger proportion of value-laden examples and borderline cases in the non-news articles.

This is likely to be linked to the particular role that such articles have within newspapers and other media. Comment and editorial media pieces tend to be characterised by the expression of personal opinions and do not always purport to be reporting science or other facts in neutral ways.

[44] Articles were classified as 'news' if they reported on current events and science topics. All other articles, including editorials, features, comment pieces, book reviews, and life style articles, were classified as 'non-news'.

Figure 4: comparison of different kinds of use of all terms (*natural, unnatural* and *nature*) identified in news and non-news media articles from 2010-5[45]



Bolder, sometimes unsympathetic, language tends to be used in non-news articles, as this example demonstrates:

> *"'Trust me, ladies... men love real fruit not plastic'... most young women are not having breast reconstruction because they have had a mastectomy. They are doing it because of vanity, rock-bottom self esteem and because they are under the illusion that men prefer fake breasts. Can we finally kill this lie? Men who prefer fakes don't love women. As a man, I can exclusively reveal that fake breasts are a giant turn-off for any red-blooded male. They are hard, unfeeling,* ***unnatural,*** *as well as a health hazard*…" (The Sun, 2013)

There was also a higher proportion of what we called 'discussion uses' – uses of the terms that queried or challenged the connection between naturalness and value – in non-news articles compared to news articles. The meaning of the term *natural* was reflected upon in these contexts:

> *"Our sense that species are eternal and fixed, which lies behind our discomfort with genetic modification, flies in the face of the evolutionary reality that they are in constant flux. What people think*

[45] Across all five media sources searched - The Guardian, The Telegraph, The Sun, The Daily Mail, BBC news online - 299 news articles and 330 non-news articles were found to contain one or more of the terms *natural, unnatural* or *nature* between 2010 and 2015.

*of as "**natural**" seems to be calibrated by what was technologically feasible when they were growing up."* (The Telegraph, 2013)

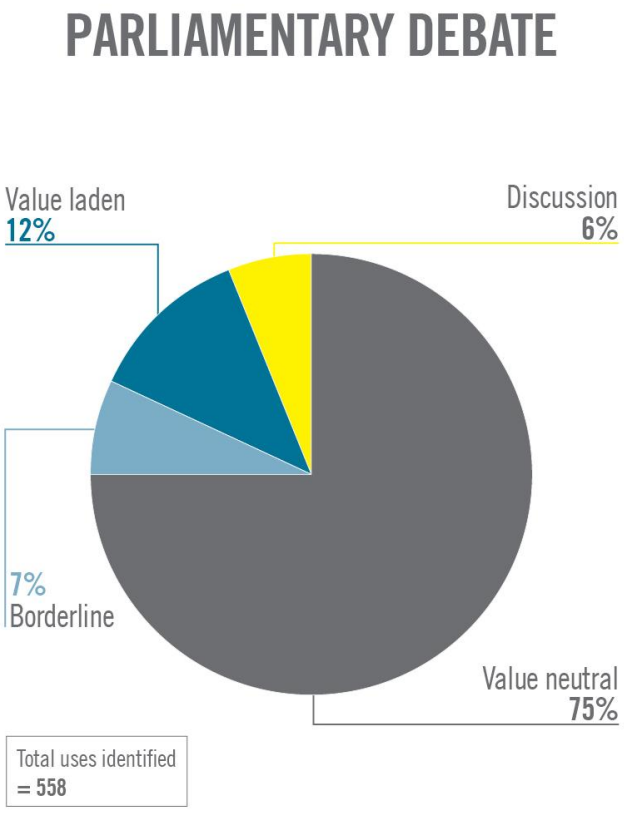
This suggests that the topic of naturalness and its connection with value is something in which the media takes an interest, and with which it engages directly. Journalists often recognise the issues that are raised by associating naturalness with value, in different contexts, and discuss or alert readers to this topic directly.

3.3 Parliament and policy

Given the influence of the media and public opinion on politics, ideas about naturalness might be expected to feature in Parliamentary debate and policy-making on science, technology, and medicine issues. Genetic modification, assisted reproduction, cloning, and others are topics on which governments implement policy and draft legislation, and ideas about naturalness have the capacity to influence the way that politicians, political advisers, and policy-makers think about these topics.

Our review of use of the terms *natural*, *unnatural* and *nature* included debates in the House of Commons and House of Lords, the Northern Ireland Assembly, Welsh Assembly Government and the Scottish Parliament. It found that, as with the other kinds of public debate, the proportion of value-laden uses of the terms within political debates was not high overall (see Figure 5 below).

Figure 5: different kinds of use of all terms (*natural, unnatural* and *nature*) identified in Parliamentary debates from 2005-2015



Some of the examples our review identified pertained to debates on legislation relevant to bioethics, such as the Human Fertilisation and Embryology Bill, and the Assisted Dying for the Terminally Ill Bill.

> *"It is the section that says that the welfare of the child includes the child's need for a father. Clause 14(2)(b) of the [Human Fertilisation and Embryology] Bill calls for the wisdom and* ***natural*** *practice of the centuries to be disregarded."* (2007)

> *"Does the [Human Fertilisation and Embryology] Bill open doors which may cause a morally dangerous strand to life? Mixing animal and human life is disturbing as it is so against* ***nature****. Both human and animal life should be respected."* (2007)

> *"Let us get on with working for patients to live as well as possible until a* ***natural*** *dignified death and teaching others how to do it, not be taken up in becoming complicit in suicide."* (2006)

Examples were also identified from debates on other prominent topics, including herbal remedies:

> *"People who tend to go down the herbal medicine route have a lot of confidence, however, because they are dealing with* ***nature*** *and* ***natural*** *products that have been used over the years." (Debate on regulation of herbal medicine,* 2013*)*

Another sphere of political discourse within which ideas about naturalness may feature is within policy papers, position statements, Committee reports and Government reviews. There are fewer uses of these terms in official policy documents than in Parliamentary debates.[46] When the notion of naturalness is confronted directly, there is instead a caution about relying on ideas about what is unnatural to inform decisions about legislation and policy.

One explicit example of this comes from an inquiry which considered the ethical issues raised by use of then-novel techniques to assist conception. The Warnock Review, which examined these issues, reported in 1984 that:

> "*... The argument that to offer treatment to the infertile is contrary to nature fails to convince in view of the ambiguity of the concepts "****natural****" and "****unnatural****". We took the view that actions taken with the intention of overcoming infertility can, as a rule, be regarded as acceptable substitutes for natural fertilisation."*[47]

UK Government policy on other topics that raise issues of naturalness, such as genetic modification and cloning, have similarly avoided overt appeal to what is

[46] The review of public debates consequently did not incorporate policy documents as evidence of public debates but some examples are discussed in this section.

[47] Report of the Committee of Inquiry into Human Fertilisation and Embryology (1984) Human Fertilisation and Embryology Authority

unnatural, with emphasis instead placed on public safety and risk assessment.[48]

Ideas about the significance of what is natural are more likely to be present in ideas underlying policy formation, albeit in sometimes subtle ways. For example, European Union regulations on applying for authorisation of new genetically modified organisms state that applicants must demonstrate that the characteristics of genitically modified food are not different to those of its conventional counterpart and must have "*regard to the accepted limits of **natural** variations for such characteristics"*.[49] A recently published European Commission statement describes the primary ethical considerations raised by synthetic biology, suggesting that it may:

> *1. Blur the distinction between life and non-life*
> *2. Interfere with **nature***
> *3. Widen the gap between have and have-not countries and sectors of society*
> *4. Due to premature use or misuse, lead to serious threats to society (a biosecurity issue, too).*[50]

European Union public-facing material on genetically modified organisms also aims to emphasise links between genetically modified crops and the exploitation of natural processes used in more traditional farming:

> *"Food and feed generally originates from plants and animals grown and bred by humans for several thousand years. Over time, those plants and animals with the most desirable characteristics were chosen for breeding the next generations of food and feed… These desirable characteristics appeared through **naturally** occurring variations in the genetic make-up of those plants and animals. In recent times, it has become possible to modify the genetic make-up of living cells and organisms using techniques of modern biotechnology called gene technology."*

In the US, concerns about unnatural technologies were taken seriously in the President's Council on Bioethics' 2002 report *Human cloning and human dignity: an ethical inquiry* which recommended a ban on human cloning to produce children and a moratorium on cloning for the purposes of medical research, arguing that:

> *"… In cloning experiments to produce children, researchers would be transforming a sexual system into an asexual one, a change that*

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48 Health and Safety Executive (2015) *The SACGM compendium of guidance: part 2 - risk assessment of genetically modified microorganisms (other than those associated with plants)*, available at: http://www.hse.gov.uk/biosafety/GMO/acgm/acgmcomp/part2.pdf.

49 EUR-Lex (2003) *Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed*, available at: http://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32003R1829.

50 European Commission (2015) *Opinion on synthetic biology II: risk assessment methodologies and safety aspects*, available at: http://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_o_048.pdf.

> *requires major and "**unnatural**" reprogramming of donor DNA if there is to be any chance of success."*[51]

Whether or not UK policy is ever directly influenced by ideas about naturalness, policy-makers sometimes respond to concerns about what is natural or unnatural in public discussions about science, technology, and medicine. The Food Standards Agency (FSA) website provides information on cloning, for example, which reassures readers that *"clones occur in **nature** and many plants, such as strawberries, propagate this way"*[52] and the Agency's advice on nanotechnologies is that *"in their widest sense, nanotechnology and nanomaterials are a **natural** part of food processing and conventional foods, because the characteristic properties of many foods rely on nanometre sized components"*.[53]

It may be, therefore, that ideas about naturalness feature in debates about policy formation in ways that are less visible and harder to identify. These ideas may, nevertheless, subtly influence the way that policy is formed and communicated.

3.4 Civil society organisations

There are many organisations, including charities, non-governmental organisations (NGOs), and think tanks, which undertake research and campaign on issues raised by advances in science, technology, and medicine. Ideas about naturalness can inform the work of these organisations and how they develop positions on the acceptability of new technologies. These organisations can be influential players in national policy development on science issues and can exert influence on how members of the public think about the use and application of novel technologies.

There are a number of areas relevant to naturalness which organisations of this kind focus on, such as the environment and conservation, fertility and parenthood, and farming and food production. The work of organisations concerned with broader, cross-cutting themes, such as the different applications of genetic modification techniques in food, farming, fertility and medicine, can also be influenced by ideas about what is natural and unnatural.

For example, in its 2014 report *Smart breeding: the next generation*, which explored the use of alternative biotechnologies to genetic modification to support breeding, Greenpeace notes:

> *"… People raise ethical concerns regarding intellectual property issues on crops and genes; about scientists "playing god", as crops are transformed in **unnatural** ways and about the implications for traditional beliefs and values."*[54]

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51 The President's Council on Bioethics (2002) *Human cloning and human dignity: an ethical inquiry*, available at: https://bioethicsarchive.georgetown.edu/pcbe/reports/cloningreport/.

52 Food Standards Agency (2015) *Cloned animals*, available at: http://www.food.gov.uk/science/novel/cloned.

53 Food Standards Agency (2015) *Nanotechnology*, available at: http://www.food.gov.uk/science/novel/nano.

54 Greenpeace (2014) *Smart breeding: the next generation - marker assisted selection: a biotechnology for plant breeding without genetic engineering*, available at:

The Soil Association, which works on issues relating to farming and food production, invoked ideas about what is unnatural in its 2001 report *Too hard to swallow: the truth about drugs and poultry*:

> *"In this case, the specific problems are the **unnatural** feeding practices and unsanitary, overcrowded, moist, dark, confined conditions in which large numbers of chickens are kept – conditions under which most would undoubtedly perish without drugs to keep them alive until slaughter."*[55]

Human Genetics Alert works on a range of issues to which naturalness relate including cloning, reproduction, genetics and health and mitochondrial replacement techniques. In its 2011 report, *No to eggsploitation: the case against payments for egg donation*, it stated:

> *"A normal cycle is controlled by a set of finely tuned feedback mechanisms designed to produce only one mature egg per month, so the body's complex system is being forced to do something very **unnatural**, and this requires large hormone doses. It is not surprising that these would have potentially dangerous effects on the body."*[56]

Our review into the use of the terms *natural, unnatural* and *nature* found that, as with other arenas of debate, the proportion of uses of the terms that were value-laden within civil society publications was not high overall (see Figure 6 below).

However, civil society publications featured a notably lower proportion of discussion uses of the terms *natural, unnatural* and *nature* than media and political sources, indicating that engagement with, and challenges to, ideas about the connection between naturalness and value were less common.

The Christian Medical Fellowship was somewhat unusual within the group of civil society organisations in addressing this topic directly in more than one report:

> *"We need to be careful of falling into the trap of assuming that if something occurs in '**nature**' then it must be good."*[57]

> *"Ted Peters in his book 'Playing god?' makes a point that needs to be emphasised in today's Nature-glorifying society. He emphasises that just because something is **'natural'** does not make it right."*[58]

> *"The problem is that simply being **natural** does not necessarily*

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http://www.greenpeace.org/international/Global/international/publications/agriculture/2014/468-SmartBreeding.pdf, at page 42.

55 Soil Association (2001) *Too hard to swallow: the trust about drugs and poultry*, available at: http://www.soilassociation.org/LinkClick.aspx?fileticket=2%2BoyELRyepc%3D&tabid=385.

56 Human Genetics Alert (2011) *No to eggsploitation: the case against payments for egg donation*, available at: http://www.hgalert.org/NotoEggsploitation.pdf, at page 4.

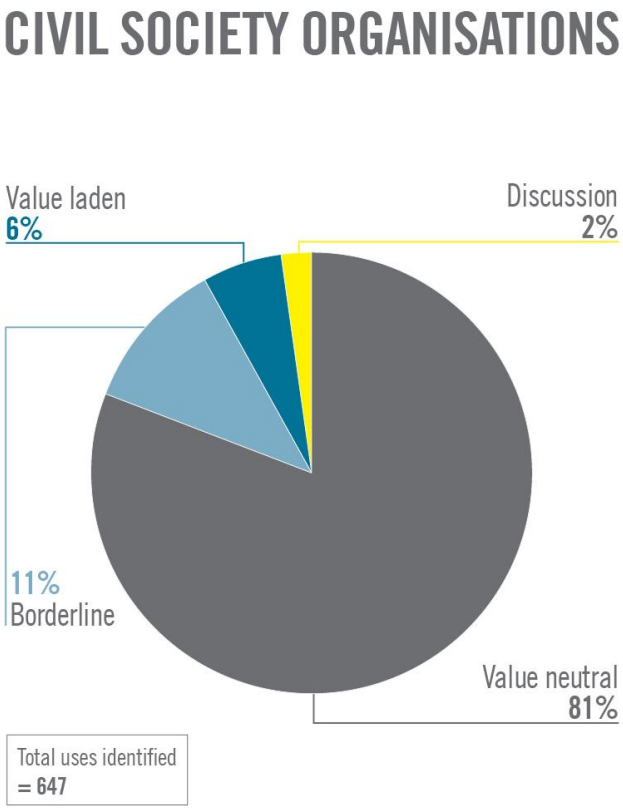
57 Christian Medical Fellowship (2007) *Chimeras, hybrids and 'cybrids'*, available at: http://admin.cmf.org.uk/pdf/cmffiles/34_hybrids.pdf.

58 Christian Medical Fellowship (2001) *Genes and behaviour*, available at: http://admin.cmf.org.uk/pdf/cmffiles/14_genes_and_behaviour.pdf.

*make a feeling right. A doctor may have a '**natural** instinct' to ignore a rude smelly patient, though if she cares, she will still respond to the patient's needs."*[59]

The lower proportion of discussion uses in the work of civil society organsiations may be related to the tendency of organsiations of this kind to adopt and defend a distinctive stance on the use of particular kinds of novel science, technology or medicine, which may sometimes take as a starting point the idea that natural processes and techniques are good.

Figure 6: different kinds of use of all terms (*natural, unnatural* and *nature*) identified in reports of civil society organisations from 1995-2015



[59] Christian Medical Fellowship (1999) *The ethics of caring*, available at: http://admin.cmf.org.uk/pdf/cmffiles/05_ethics_of_caring.pdf.

3.5 Science organisations

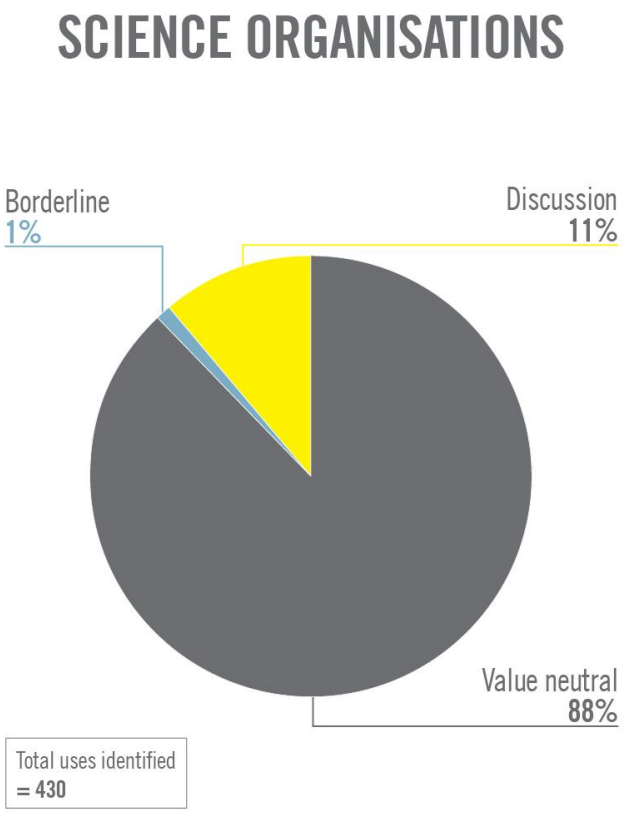
Science, as the study of nature, might be thought to provide a distinctive perspective on the connection between naturalness and value. The topic of naturalness and its relation to value and ethics has featured, indirectly, in a number of learned society reports and the work of other bodies representing the views of scientists.

Within our review of uses of the terms *natural, unnatural* and *nature,* one of the most striking findings was that there were no value-laden uses of these words and borderline cases of the terms were almost non-existent in the publications of organisations representing scientists (see Figure 7 below).

The following example typifies the kinds of value-neutral use of these words within the work of science organisations:

> *"Established genetic engineering techniques include using the* ***naturally*** *occurring plant pathogen Agrobacterium to insert genes in the genome of an organism, typically at a random position."*[60]

Figure 7: different kinds of use of all terms (*natural, unnatural* and *nature*) identified in reports of science organisations from 1995-2010



[60] BBSRC (2014) *New techniques for genetic crop improvement: position statement*, available at: http://www.bbsrc.ac.uk/documents/genetic-crop-improvement-position-statement-pdf/.

Conversely, science organisations made more frequent use of the terms that were categorised as 'discussion' uses.This suggeststhat these publications engage more frequently with questions about the relationship between naturalness and value.

> *"Whether a chemical kills pests, and the speed at which it does, has nothing to do with whether the chemical is **natural** or synthetic, but is to do with the properties of the chemicals and how they kill insects."*[61]

Whilst these reports engage with concerns about naturalness, these perspectives tend to express scepticism both about there being any robust, defensible distinction between the natural and unnatural and that assuming that what is natural must be good, and unnatural bad.

An Academy of Medical Sciences' report published in 2007 which discussd the scientific and ethical issues raised by the creation of cytoplasmic hybrid embryos discusses ideas about naturalness in the following way:

> *"Not only is it very difficult to specify what '**unnatural'** means, but it is not clear why '**unnaturalness**' should be bad; IVF is an '**unnatural**' process, but it has few contemporary opponents. Vaccination and antibiotic therapy, and nearly all of modern medicine, represent a scientifically informed intervention in **nature**. Indeed all innovation is in a sense **unnatural**."*[62]

Similar views are also expressed in the work of Sense About Science, an organisation which campaigns on issues relating to public knowledge and perception of science. The organisation has undertaken work on a range of issues relevant to this topic, including the use of chemicals, genetically modified food, detox diets, and farming. In a2014 report, it observes:

> *"The chemical reality is that whether a substance is manufactured by people, copied from nature, or extracted directly from **nature**, tells us nothing much at all about its properties. In terms of chemical safety, "industrial", "synthetic", "artificial" and "man-made" do not necessarily mean damaging and "natural" does not necessarily mean better."*[63]

In 2015, Sense about Science held an online debate on the topic of naturalness, titled: *'What does 'natural' actually mean*?' The organisation's plant science panel answered questions from the public on how naturalness relates to issues in farming, food, and medicine. A theme running through the discussion concerned the notion 'natural' methods of farming and agriculture. Plant scientist Professor Ottoline Leyser made the following observation within the debate:

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61 Professor Nick Price, cited in Sense About Science (2007) *Celebrities and science*, available at: http://www.senseaboutscience.org/data/files/resources/50/Microsoft-Word-Celebrity-Review-2007-FINAL-TB.pdf.

62 Academy of Medical Sciences (2007) *Inter-species embryos*, available at: https://www.acmedsci.ac.uk/viewFile/publicationDownloads/118356622535.pdf.

63 Sense About Science (2014) *Making sense of chemical stories*, available at: http://www.senseaboutscience.org/pages/making-sense-of-chemical-stories.html.

> *"Organic farming is a method of farming widely perceived as "more **natural**" than conventional farming... "**natural** farming" is an oxymoron. Farming is a profoundly **unnatural** process involving the deliberate manipulation of the environment and of plant genetics to provide safer, more nutritious and more abundant food. We have been doing this for 10,000 years. So from that point of view organic and conventional farming are equally **unnatural**."*[64]

The Biotechnology and Biological Sciences Research Council (BBSRC) also explored the topic in 2014, and observed that the distinction between the natural and the artificial was *"incoherent"*, noting further that what is seen as natural and unnatural may change according to individual, social group and societal perspectives.[65] The BBSRC concluded that the difference between the natural and unnatural is intelligible only as a proxy for the distinction between what is believed to be right and wrong.

> *"Distinctions between the natural and unnatural however may be more comprehensible if they are understood as moral judgements".*[66]

Further afield, the same view is reflected in the work of US-based science organisations. For example, in a 2009 discussion document prepared for the US National Science Foundation, the following distinction is made between the natural and the artificial:

> *"... The natural-versus-artificial distinction, as a way to identify human enhancements, may prove most difficult to defend given the vagueness of the term "natural." For instance, if we can consider X to be natural if X exists without any human intervention or can be performed without human-engineered artifacts, then eating food (that is merely found but perhaps not farmed) and exercising (e.g. running barefoot but not lifting dumbbells) would still be considered natural, but reading a book no longer qualifies as a natural activity (enhancement or not) since books do not exist without humans."*[67]

Wholesale scepticism about the connection between what is natural and what is good is not held universally amongst scientists however. Evolutionary biologist W. D. Hamilton has been interpreted as a critic of 'unnatural' interventions, criticising the 'over' medicalisation brought by "*ever advancing technology*"[68] and advocating that

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64 Sense About Science (2015) *What does 'natural' actually mean?* , available at: http://www.senseaboutscience.org/pages/natural-qa.html.

65 Biotechnology and Biological Sciences Research Council (2015) *Debating the nature of 'natural'*, available at: http://www.bbsrc.ac.uk/research/topical/debating-the-nature-of-natural/.

66 Ibid.

67 Allhoff F, Lin P, Moor J and Weckert J (2010) Ethics of human enhancement: 25 questions & answers *Studies in Ethics, Law, and Technology* **4(1)**.

68 Hamilton WD (1998) *Narrow roads of gene land: the collected papers of W. D. Hamilton - volume 3: last words* (Oxford: Oxford University Press).

people should, in many areas of health intervention, instead let 'nature take its course'.[69] In an account of preparing to speak at the Vatican, Hamilton explains:

> *"... I intended to cover on the one hand how drastically we were indeed, in the short term, changing our external and environmental 'Nature' by the combination of our technology and our overpopulation and on the other how, in the long term, we were changing (and in this case micro evolving for the worse) our own internal 'Nature' – that is, our own genome. To a substantial extent the latter trend as coming through our recent and unnatural ethica that every conceptus, no matter how mutated, was deserving of every technical effort we knew to make it survive."*[70]

This statement appears to reflect a considered scepticism in Hamilton's view about the extent to which human beings should intervene in natural processes.

Alongside this kind of substantive position on the natural there are also examples of scientists using the terms *natural, unnatural* and *nature*, in more casual ways, that appear to associate these notions with what is good and bad. For example, Allan Pacey (a professor of Andrology), recently commented made the following comment to the media on evidence that children of older fathers may achieve lower scores in IQ tests said that:

> *"…the author's observation that most neurocognitive outcomes are also reduced in the children of older fathers provides a further piece of evidence to remind us that* ***nature intended us*** *to have our children earlier in our lives than we currently are".*[71]

In addition, evolutionary psychologist Stephen Pinker, discussing the role that genes may play in determining character, has noted that:

> "...*The theory that parents can mold their children like clay has inflicted childrearing regimes on parents that are* ***unnatural*** *and sometimes cruel*."[72]

In these cases, it is less clear that any negative stance towards 'unnatural' activities is really being adopted or expressed; as with the many other examples of this kind already cited in this review, it is not immediately obvious precisely what is being said with such statements. There are different ways of interpreting those who appeal to the natural, unnatural and nature in these ways. As we go on to discuss in section 4, there are a range of meanings that might be expressed by those who use ideas about naturalness to invoke value.

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69 This is the interpretation given by David Haig in his review of Hamilton's autobiography and collected papers. See: Haig D (2003) The science that dare not speak its name *The Quarterly Review of Biology* **78(3)**: 327-35.

70 Allhoff F, Lin P, Moor J and Weckert J (2010) Ethics of human enhancement: 25 questions & answers *Studies in Ethics, Law, and Technology* **4(1)**.

71 BioNews (16 March 2009) *Study finds link between older fathers and lower IQ scores in children*, available at: http://www.bionews.org.uk/page_13722.asp.

72 Pinker S (2003) *The blank state: the modern denial of human nature* (London: Penguin Books).

3.6 Commercial sector

A separate arena in which ideas about naturalness can be important is the commercial retail sector.[73] The marketing of certain kinds of products, including food and drink, complementary and alternative medicines and health supplements, cosmetics, and household cleaning products, often makes appeal to the idea that natural products are better, healthier, or gentler than unnatural, artificial or 'chemical' products.

A number of brands feature the terms *natural* or *nature* in their names – for example, Eat Natural and Nature's Path, which produce cereals and snack bars, Nature's Way and Good 'n Natural which sell complementary and alternatve medicines and health supplements, and the Natural Soap Company and Faith in Nature, which sell soaps and moisturisers. There are also a number of retail websites such as The Natural Store and The Natural Grocery Store that offer a range of products manufactured by different companies which are marketed on these sites as 'natural products'.

An even wider range of commercial products are described as natural in promotional and marketing materials. In the food and drink sector, for example, drinks producer *Innocent* describe their purpose as being to make *"natural, delicious food and drink that helps people live well..."* and their promotional material claims that: *"...everything Innocent make will always be 100%* ***natural****, delicious and nutritionally net-positive."*[74]

Ecover, which manufactures detergent and other household cleaning products, describe nature as a source of knowledge and inspiration in the design of its products: *"Ecover have learned from* ***nature****: our products are designed to provide a cleaner clean inspired by* ***nature's*** *genius."*[75]

Complementary and alternative medicines and health supplements are also often described using references to nature and what is natural. This is particularly common with digestive health and 'detox' products for issues such as abdominal bloating. Holland and Barrett, for example, sell a range of remedies and supplements described as an "*unparalleled range of natural health products".* One of the products sold, Bootea 14 day Teatox, which is designed to support weight loss, is described as *"****a*** *clever blend of gentle herbs harness* ***nature's*** *power to give you a helping hand."*[76]

Neal's Yard, a cosmetics manufacturer, states that its products are "***natural****, safe and ethical*". Similarly, L'Oréal describes its subsidiary brand, The Body Shop, as "*all-natural, distinctive and socially engaged".* Another cosmetics brand, Lavera, claims that its products' "***natural*** *ingredients are particularly gentle"*.

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[73] Our *Review of media, Parliamentary, civil society science sources* did not include a review of advertisements, though a selection of examples of promotional materials from a range of products are cited in this section.

[74] Innocent (2015) *Careers*, available at: http://www.innocentdrinks.co.uk/us/careers.

[75] Ecover (UK) (2015) *Homepage*, available at: http://uk.ecover.com/en/.

[76] Holland and Barrett (2015) *Shop*, available at: http://www.hollandandbarrett.com/shop/product/bootea-teatox-60035242

Within the cosmetics sector, the notion of the natural appears to play a dual role in the language used by marketeers. Sometimes it is the composition of a cosmetic product that is depicted as natural, and superior, insofar that it does not include chemical or synthetic ingredients. For example, the online platform SoOrganic suggests that:

> *"... If you're keen to avoid chemicals then **natural** eye makeup such as organic eyeshadow, organic eyeliner and **natural** mascara deserve to find their way into your makeup bag."*[77]

Additionally, the effects of using a cosmetic product are sometimes described this way. For example, French cosmetics brand Bourjois sell a Brow Natural pen which they claim will "*subtly... enhance*" eyebrows and give a "*natural finish"*. British cosmetics company Rimmel promote their skin make-up similarly as providing a "*natural looking flawless finish*". There are many other examples of this kind.

The promotion of more invasive cosmetic products and services sometimes makes use of this language too. Dermal fillers, which are injected into the skin, are described by one manufacturer, Juvaderm, as providing a *"smooth, natural look and feel."*

The positive connotations of 'natural' products as nutritious, organic, pure, gentle, attractive, and safe are often directly contrasted with descriptions of rival products as artificial or synthetic. Ecover, for example, claims that its products are *"inspired by nature's genius without the **chemical** nasties"*; Neal's Yard similarly states that:

> *"Our passionate belief that beauty should be natural, not **synthetic**, has been at the heart of our business since we started, over 30 years ago. We believe in **nature**, honesty and transparency..."*[78]

Some of the descriptions cited above, such as those that claim that products are 'delicious', 'gentle' or 'flawless', appear to associate the natural with some positive effects, such as nutritional value or taste, or with gentleness. Material which refers to 'honesty' and 'transparency' seems to link naturalness with ethics and good business practices.

Claims made by commercial companies about products being natural are made within a wider advertising context and are, as such, subject to broader trading standards and regulation. In the UK, for example, it is a statutory offence to produce misleading advertising material.[79] The Advertising Standards Authority (ASA) is the UK's regulator for advertising across all media and can request advertisers change or withdraw adverts which do not meet these standards. The ASA can refer advertisers to Trading Standards in cases where their own sanctions are not effective.

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[77] SoOrganic (2015) *Organic makeup and organic cosmetics*, available at: http://www.soorganic.com/organic-make-up-and-organic-cosmetics/mascaraandeyeliners.html

[78] Neal's Yard (2015) *About us*, available at: http://www.nealsyardremedies.com/about-us-pages/about-us.html.

[79] Under the Consumer Protection from Unfair Trading Regulations 2008 and the Business Protection from Misleading Marketing Regulations 2008.

The ASA has upheld a number of complaints made about misleading advertisements which make use of the term *natural*.[80] For example, a complaint made in 2014 was upheld against Natvia PTY Ltd., which promoted its artificial sweetener as *"100% natural*". The ASA concluded that this description was likely to mislead, since *"the production of Nativa went through several processes, including re-crystallisation, which could be equated to 'concentration'."*[81] Similarly, a 2013 case concerning an advertisement for a product to treat snoring, Asonor, which said that it *"contains natural ingredients and therefore there is not any known side effect"* was upheld partly on the grounds that the Authority had received no evidence that it contained natural ingredients.[82]

The existence and force of field-specific regulation and guidance on the use of the terms *nature* and *natural* in commercial contexts depend on the type of product to which they are applied.

Food and drink

In the case of food and drink, European Union (EU) legislation sets out broad rules which hold that the labelling and presentation of food and drink products should not mislead people.[83] EU regulation also governs the use of *natural* and *naturally* in the context of claims about nutrition, and specifies the ways in which foods can be legally described as "naturally low in fat" or "naturally high in protein".[84]

In the UK, the Food Standards Agency (FSA) published non-binding guidance in 2002 on general use of the term *natural* (alongside similarly well-used terms such as *pure, fresh,* and *traditional*) in food labelling and marketing. The aim of the guidance is to *"assist manufacturers, producers, retailers and caterers in deciding when these descriptions may be used and when they should not, and help enforcement*

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80 According to information supplied to the Council by the ASA, the number of complaints in the two years between November 2013 and November 2015 was 19, with one falling outside the ASA's remit, and 11 found not to have breached the ASA code upon initial assessment. Seven complaints were investigated, with six advertisers agreeing to make amendments. One formal ruling was published.

81 Advertising Standards Authority (2014) *ASA ruling on Natvia Pty Ltd.*, available at: https://www.asa.org.uk/Rulings/Adjudications/2014/4/Natvia-Pty-Ltd/SHP_ADJ_205274.aspx#.VkS_fdLhBph.

82 Advertising Standards Authority (2013) *ASA ruling on JazzyDeals Ltd.*, available at: https://www.asa.org.uk/Rulings/Adjudications/2013/7/JazzyDeals-Ltd/SHP_ADJ_228271.aspx#.VldOldLhBpg.

83 EUR-Lex (2002) *Regulation (EC) no 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety*, available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32002R0178.

84 But do not aim to clarify what naturalness consists in for food and drink products generally. The legislation sets out the conditions under which a food can be said to 'naturally' meet the criteria set out for other food labelling categories defined in the Regulation. For example, the regulation states that 'high protein' foods are those for which 20% of their energy is composed of protein and stipulates that a food can only be described as 'naturally high in protein' when it is naturally constituted this way: "...where a food naturally meets the condition(s) laid down in this Annex for the use of a nutritional claim, the term 'naturally/natural' may be used as a prefix to the claim". See: EUR-Lex (2006) *Regulation (EC) No 1924-2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods*, available at: http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:02006R1924-20121129.

authorities to provide consistent advice about labelling"[85]. However, there is no legal obligation to follow the recommended criteria.

In 2004, the FSA carried out a survey which found that 40 per cent of sample advertisements examined were considered not to follow the guidance. It commissioned further research into consumer expectations and understanding of the use of *natural* and other terms in food labelling in 2006 and the guidance was revised in 2008 to take account of this work. The updated guidance contains detailed advice on the use of the term *natural* in food labelling and marketing and, based on its research, provides a commonly understood definition of a natural product:

> *""Natural" means essentially that the product is comprised of natural ingredients, e.g. ingredients produced by nature, not the work of man or interfered with by man. It is misleading to use the term to describe foods or ingredients that employ chemicals to change their composition or comprise the products of new technologies, including additives and flavourings that are the product of the chemical industry or extracted by chemical processes."*[86]

The FSA guidance acknowledges the different implications of the use of the term *natural* in descriptions of different kinds of food and drink, such as dairy produce and bottled water, and provides broader advice on the use of the term in food and drink labelling. The general criteria states, for example, that *natural* should only be used to describe foods *"to which nothing has been added and which have been subjected only to such processing as to render them suitable for human consumption."*[87]

In respect to claims about naturalness and nutrition, food labelling and advertising must also conform to EU regulations. This regulation is explained the FSA guidance as:

> *"This Regulation also allows the use of "naturally" or "natural" to prefix claims such as "low salt", "sugar free" or "high protein" when the food naturally meets the condition(s) laid down in the Annex for the use of a nutrition claim. Within the context of the health and nutrition claims legislation it is suggested that "naturally / natural" means that either nothing has been removed or nothing has been added to the food, and additionally that the food has not been subjected to any processes or treatment to render it such that it meets the condition."*[88]

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85 Food Standards Agency (2008) *Criteria for the use of the terms fresh, pure, natural etc. in food labelling*, available at: http://www.food.gov.uk/sites/default/files/multimedia/pdfs/markcritguidance.pdf, at paragraph 51.

86 Ibid, at paragraph 1.

87 The criteria also clarifies further which kinds of processes are compatible with labeling a food or drink natural and include, for example, smoking without chemicals, baking, roasting, blanching and physical sieving and exclude processes like freezing, concentration, pasteurization and sterilsation. The full criteria document sets out a range of other guidance. See: Ibid.

88 Ibid, at paragraph 54.

Despite the existence of this guidance and regulation, some still perceive vagueness and ambiguity in the use of the terms *nature, natural* and *unnatural* in the promotion of food and drink products. The topic is discussed regularly in the media, both within and outside the UK. A recent *Guardian* article by food writer Joanna Blythman, for example, suggested that parts of the food industry were guilty of obfuscation in food labelling. Blythman criticises companies for implying – misleadingly, in her view – that features of their produce, such as colourings and flavourings, are natural in any significant respect:

> *"Even the flavour industry concedes that "there isn't much difference in the chemical compositions of natural and artificial flavourings". They are made using the same physical, enzymatic, and microbiological processes."*[89]

In the US, criticism of food manufacturers on these grounds has been even more pronounced and there have been a number of cases in which companies have faced legal challenge to the use of the term *natural* in the promotion of their products. According to the New York Times, in the last few years, *"200 class-action suits have been filed against food manufacturers, charging them with misuse of the adjective in marketing such edible oxymorons as "natural" Cheetos Puffs, "all-natural" Sun Chips, "all-natural" Naked Juice, "100 percent all-natural" Tyson chicken nuggets and so forth."*[90] A recent article in the magazine *Wired* has also described the term *natural* in these contexts as *"almost completely meaningless."*[91]

A poll conducted by consumer organisation *Which?* in 2010 suggested that people in the UK felt confused by the use of the terms in food and drink labelling and *"that certain food and drink brands are baffling people with how they market products with words such as 'pure', 'fresh', 'natural' and 'real'."*[92] The Nuffield Council's own public dialogue work explored this topic and we found that many participants thought that the terms were vague and unhelpful in the context of food and drink labelling and promotion. One participant stated:

> *"I don't believe in the word natural anymore – if I see it in a supermarket I think yeah right... advertising on food, you don't believe anyway!"*[93]

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89 The Guardian (21 February 2015) *Inside the food industry: the surprising truth about what you eat*, available at: http://www.theguardian.com/lifeandstyle/2015/feb/21/a-feast-of-engineering-whats-really-in-your-food..

90 The New York Times Magazine (28 April 2015) *Why 'natural' doesn't mean anything anymore*, available at: http://www.nytimes.com/2015/05/03/magazine/why-natural-doesnt-mean-anything-anymore.html?_r=0.

91 Wired (1 June 2015) *America needs a definition of what a 'natural' food is*, available at: http://www.wired.com/2015/06/america-needs-real-definition-natural-food/.

92 Which? (25 August 2010) *Food labels to take with a pinch of salt*, available at: http://www.which.co.uk/news/2010/08/food-labels-to-take-with-a-pinch-of-salt-225797.

93 Report of Public Dialogue Workshop (2015) *Ideas about naturalness in public and political debates about science, technology and medicine: Report of Public Dialologue Workshop*, available at: http://nuffieldbioethics.org/project/naturalness/evidence-gathering/

Complementary and alternative medicines and health supplements

In the domain of complementary and alternative medicine and health supplements, the way that products can be described depends on how they are classified according to Medicines and Healthcare products Regulatory Agency (MHRA).

The broad group of complementary and alternative remedies includes products that are considered to be medicines, which are regulated by the MHRA; and those that are not, which are not subject to MHRA regulation. The MHRA's *Blue guide: advertising and promoting medicines*[94] makes clear that *"... the inclusion of herbal or 'natural' ingredients does not exclude a product from being a medicinal product"* and once the status of a product has been determined as a medicine, it must adhere to regulations on the advertising of medicines.[95] This includes the requirement that advertising materials *"must not make misleading claims..."* and *"must not claim a medicine's safety or effectiveness is due to the fact it is natural"*. Breach of the regulations is a criminal offence and the penalty is a fine and/or imprisonment for a period of up to two years.[96] In 2014, the MHRA upheld one complaint against an advertisement for an over-the-counter product concerning claims that a product's efficacy and safety were a consequence of its natural active ingredient. [97]

Some complementary and alternative remedies have a different status and are instead classified by the MHRA as *herbal medicines*. Manufacturers of these products must apply for a traditional herbal registration (THR) before they are marketed in the UK. They must follow guidance set out in an Appendix 1 to the Blue Guide which specifies the requirements under the Medicine Regulations for the promotion of traditional herbal medicines in the UK.[98]

The Proprietary Association of Great Britain (PAGB), which is the national trade association that represents manufacturers of all over-the-counter medicines and food supplements in the UK, also produces a code for the advertisement of medicines. The PAGB also approves the advertisements of its members before publication. Members of PAGB are required to follow their guidance on advertising, which states that:

> *"Advertisers shall not claim that a product is 'natural' unless all of its components are naturally occurring. 'Natural' can also be used to*

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94 Medicines and Healthcare products Regulatory Agency (2014) *Blue guide: advertising and promoting medicines*, available at: https://www.gov.uk/government/publications/blue-guide-advertising-and-promoting-medicines.

95 Part 14 of the Human Medicines Regulations 2012

96 Medicines and Healthcare products Regulatory Agency (2014) *Blue guide: advertising and promoting medicines*, available at: https://www.gov.uk/government/publications/blue-guide-advertising-and-promoting-medicines.

97 Ibid.

98 A traditional or herbal remedy cannot be registered as a THR if it purports to treat a major health condition. THRs are only available for products claiming to treat minor ailments, such as colds. Traditional or herbal remedies that do claim to treat serious health conditions must be licenced in the normal way and manufacturers must apply for a marketing authorization – or 'licence to market a medicine in the UK' - before it can put on the market. See: Medicines and Healthcare products Regulatory Agency (2014) *Apply for a traditional herbal registration (THR)*, available at: https://www.gov.uk/guidance/apply-for-a-traditional-herbal-registration-thr.

describe the particular elements of a product that are naturally occurring (e.g. 'natural ingredient').”[99]

The guidance also states that the majority of claims involving an appeal to what is natural should either refer to naturally-occurring ingredients, ingredients of natural origin, or products which have a natural mode of action. Other advice in the code is that use of the term “nature's remedy” is not acceptable.

Cosmetics

Guidance on the promotion of cosmetic products is issued by the Cosmetic, Toiletry and Perfumery Association (CTPA).[100] It does not provide detailed advice on use of the terms *nature* or *natural* in the marketing of cosmetics, although the CTPA observes on its website that: *“... the terms natural and organic are not specifically regulated under the Cosmetics Regulation but any claim must be capable of substantiation and must not be misleading.”*[101]

The CTPA have made a statement on the use of 'natural and organic claims' which makes some more specific suggestions, observing that whilst *“it may be possible to apply a natural claim to an ingredient ... it is more difficult to apply it to a finished product without the risk of misleading the consumer.”*[102]

The different levels of regulation and guidance within these different commercial fields may contribute to confusion amongst consumers over the meaning of the terms *natural*, *unnatural* and *nature* in these different contexts.

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99 Medicines Advertising Codes: Codes of Practice for advertising over-the-counter medicines which are subject to a marketing authorisation or traditional herbal registration.

100 The Cosmetic, Toiletry & Perfumery Association (2008) *Guidance for industry*, available at: http://www.ctpa.org.uk/publications.aspx?pageid=277.

101 Cosmetic, Toiletry & Perfumery Association (2015) *Natural and organic claims*, available at: http://www.ctpa.org.uk/content.aspx?pageid=431.

102 Ibid.

4. Accounts of naturalness

Section summary

In this section we describe five accounts of naturalness:

- **Neutral/sceptical**
  This view of the natural is held by those who are sceptical about the existence of any strong link between naturalness and value.

- **Wisdom of nature**
  This account of naturalness is linked to ideas about the risks attached to novel science and the pitfalls of failing to respect what is sometimes termed the *wisdom of nature*. It can involve the notion that we should trust in or rely on natural or evolved processes and make use of natural means of reproducing, eating and healing.

- **Natural purpose**
  This account of naturalness concerns what people, animals and plants are meant to do or be like, grounded in natural or evolved functions. This may derive from the natures, functions or essences of beings, which determine what is good or right for those beings.

- **Disgust and monstrosity**
  This account of naturalness concerns the kinds of responses that people have to some novel technologies. These may be responses of disgust, repugnance, revulsion or may be linked to ideas about monstrosity, horror and notions from science fiction.

- **God and religion**
  This account of naturalness involves the idea that certain technologies serve to undermine a divine natural order, distort God's creation or otherwise contravene the will of God.

4.1 Introduction

So far, we have drawn upon evidence gathered from public and political debates relating to ideas about naturalness to inform a discussion of the evidence gathered from our review of media, political, civil society and science sources. We have also considered examples from the commercial sector, research on public perspectives on naturalness, and the Council's previous work on relevant topics. In this section, we now identify themes which run through public debates involving ideas about naturalness and outline five accounts of naturalness.

With the exception of the first account, many of the ideas, concepts and arguments expressed within each of these discussions are closely related to one another and overlap in significant ways. Some of the examples identified during our evidence gathering activities appear to employ a set of distinct, but overlapping, ideas within

one formulation of words. This suggests that entirely separting out the different thoughts underlying people's opinions about the natural and unnatural may, to some extent, simplify the underlying ideas. There are also likely to be other ways of organising these interconnected thoughts and ideas.

It is important to note that this work does not attempt to resolve the matter of which, if any, account of naturalness might be 'correct'. We consider some of the key points and arguments within academic discussion and attempt to indicate where there are challenges to particular views. Our aim is not to criticise or defend any particular conception of naturalness; rather it is to clarify, elucidate and illuminate the many different ways that the notion is deployed by different people in public debates about science, technology and medicine in order to better understand the range of ideas that underlie the use of these words in these contexts. We also consider how debate about the ethics of science, technology, and medicine conducted using these terms might be influenced as a result.

4.2 Neutral/sceptical

Some people do not use the words *natural* and *unnatural* to communicate any message about what is acceptable or unacceptable, and do not apparently hold any views about the importance of naturalness for the ethics of science, technology and medicine. There is therefore a conception of naturalness that does not connect the natural with value at all. This view was evident in many examples identified in the review, as well as within research on public perspectives.

This view of the natural is exemplified by positions, already discussed, adopted by some philosophers and scientists, which express scepticism about the existence of any robust distinction between the natural and unnatural. Those who believe it is not possible to separate the natural from the unnatural, and thereby specify what naturalness consists in, may be more likely to hold this view.

However, there may be other reasons for doubting the link between naturalness and value. Even those who think that it is possible to distinguish the natural from the unnatural may resist the idea that natural things are always good, and unnatural things always bad. This may be because they think that there are natural things that are bad, like disease and famine, and unnatural things that are good, like medicine and space exploration.

The many uses of *natural*, *unnatural* and *nature* identified in the review of media, Parliamentary, civil society and science sources which were classified as discussion uses provide examples of the neutra /sceptical view. Many directly challenged the assumption that the natural is good.

For example, there were numerous cases of writers and speakers using the terms to question presumptions about the superiority of natural reproduction, natural ageing or natural foods. Similarly, many reports questioned the idea that the unnaturalness of genetically modified food or cloning was ethically significant:

> *"Ian added: "These days there is really no 'normal' or **'natural'** or 'right' way to have a baby. Surrogacy may not be a traditional way to have a child - but it's our way.""* (The Sun, 2011)

> *"In fact, the organic creed is founded on the principle that synthetic chemicals are bad and dangerous, while natural chemicals are safe and good. That is, of course, a scientific howler. It ignores the fact that a molecule is a molecule, whether man-made or **natural**."* (Parliamentary debate on Agriculture: organic farming, 2007)

> *"We need to be careful of falling into the trap of assuming that if something occurs in '**nature**' then it must be good."*[103]

> *"Opposition to existing and emerging biotechnologies is often based on the argument that **nature** must be protected and that mankind does not have the right to manipulate plant, animal or human DNA. The RSE, however, would argue that mankind is part*

[103] Christian Medical Fellowship (2007) *Chimeras, hybrids and 'cybrids'*, available at: http://admin.cmf.org.uk/pdf/cmffiles/34_hybrids.pdf.

> *of **nature**, not separate from it."* (Royal Society of Edinburgh, 2009, *Response to House of Commons Science and Technology Committee Inquiry on Bioengineering*)

Sometimes this challenge was posed through querying the idea that there is any clear-cut distinction between natural and unnatural things: for example, by drawing a parallel between the two:

> *"GM is a development in a long line of plant breeding techniques. Older techniques shuffled the plant's genes, leading to lots of unintended changes, whereas GM is more precise. It is relatively new (though over 20 years old) but many of the comments that it is "**unnatural**" are just as true of plants bred for conventional and organic agriculture*."[104]

And sometimes by directly querying the idea that natural things are good and unnatural things bad:

> *"Debate [on genetic modification] was unwelcome for the most part, scientists were just another part of the conspiracy, and placards took absolute positions like "**Nature** does it better" - try telling that to plague victims, or anyone with wisdom teeth."* (The Guardian, 2012)

The neutral or sceptical view has also been represented in research into public perspectives, with some research participants pointing out that *"nature isn't perfect in a lot of ways anyway*" and observing that *"even natural drugs have side effects*."[105]

In philosophical contexts, the assumption that the natural is good is sometimes presented as involving a bogus inference from the way the world actually *is*, to the way it *ought* to be. This is referred to as the is/ought distinction, or the fact/value distinction, and is sometimes linked with the naturalistic fallacy.[106] Assuming that natural states of the world are good, and should be conserved or promoted, involves making an unwarranted supposition about the value of natural states of affairs. This observation is associated with the Scottish philosopher David Hume who argues that what *ought to be* the case cannot be deduced from what *is* the case:

> *"In every system of morality, which I have hitherto met with, I have always remarked, that the author proceeds for some time in the ordinary ways of reasoning, and establishes the being of a God, or*

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104 Sense About Science (2009) *Making sense of GM: what is the genetic modification of plants and why are scientists doing it?*, available at: http://www.senseaboutscience.org/data/files/resources/9/MSofGM2011.pdf.

105 Coyle F and Fairweather J (2005) Space, time and nature: exploring the public reception of biotechnology in New Zealand *Public Understanding of Science* **14(2)**: 143-61.

106 So named by philosopher GE Moore as part of his Open Question Argument which seeks to establish that *good* is not synonymous with the name of any natural property, and thereby refute the case for moral naturalism. See: Moore GE (1959) *Principia ethica* (Cambridge: Cambridge University Press) . For a discussion of the Open Question Argument, see: Stanford Encyclopedia of Philosophy (2003) *Moral non-naturalism*, available at: http://plato.stanford.edu/entries/moral-non-naturalism/.

> *makes observations concerning human affairs; when all of a sudden I am surprised to find, that instead of the usual copulations of propositions, is, and is not, I meet with no proposition that is not connected with an ought, or an ought not. This change is imperceptible; but is however, of the last consequence. For as this ought, or ought not, expresses some new relation or affirmation, 'tis necessary that it should be observed and explained; and at the same time that a reason should be given, for what seems altogether inconceivable, how this new relation can be a deduction from others, which are entirely different from it."*[107]

The fact that many people appear to resist this association between naturalness and goodness, and do not routinely attach any import to what is natural, invites some critical reflection on the usefulness of the notion as a tool for use within debates about bioethics topics. Those who see what is natural in a more neutral way will often deploy these words in quite different ways to those who do connect the natural with what is good, right or ethical.

To take one example, there are a number of expressions which incorporate the term *natural* such as 'natural parent' or 'natural childbirth'. Those who do not take naturalness to be linked to value may intend to say something quite different when they use an expression like 'natural parents' to those who are inclined to use the term *natural* to convey something about value. People who see naturalness as morally significant may interpret the use of such expressions to be ascribing a superiority or 'betterness' to what is referred to as natural. In certain contexts, this may lead to misunderstanding, confusion and may be perceived to be inappropriate or even offensive on those grounds. The implications of this are discussed in more depth in the concluding section of this paper.

Section summary

The neutral or sceptical account of naturalness does not connect the natural with value at all; those who hold this view do not use the terms *natural* and *unnatural* to convey ideas about what is good and bad. One reason for this can be the difficulty of drawing a robust distinction between natural and unnatural things, and a resulting scepticism about there being any such distinction. However, even those who think that it is possible to distinguish the natural from the unnatural may resist the idea that natural things are always good, and unnatural things always bad. This may be because they think that some natural things are bad, such as disease, and some unnatural things are good, such as medicine.

[107] Hume D (1739) *A Treatise of Human Nature.*

4.3 Wisdom of nature

Evidence gathered in our review of media, Parliamentary and other sources, alongside research on public perspectives, suggests that ideas about naturalness are sometimes linked to ideas about the risks attached to novel science and the pitfalls of failing to respect what is sometimes termed the *wisdom of nature*.

Ideas about the wisdom of nature are complex: they can incorporate the notion that we should trust in, or rely on, natural or evolved processes and make use of natural means of reproducing, eating, and healing. Anxieties about naturalness may be grounded in concerns that novel technologies disregard, undermine or interfere with these systems and processes and thereby ignore age-old, highly evolved, and reliable processes and systems that have successfully governed how people, animals, and plants have existed for many centuries. These might be the systems that make up individual organisms, like plants, animals and people, or the wider environment and how different parts of nature relate to one another. Nick Bostrom, a philosopher, articulates this worry in the context of enhancement:

> *"... When we manipulate complex evolved systems, which are poorly understood, our interventions often fail or backfire. It can appear as if there is a "wisdom of nature" which we ignore at our peril. Sometimes the belief in nature's wisdom—and corresponding doubts about the prudence of tampering with nature, especially human nature—manifest as diffusely moral objections against enhancement. Such objections may be expressed as intuitions about the superiority of the natural or the troublesomeness of hubris..."*[108]

The view that we should respect the wisdom of nature may be linked to ideas about the extent of what humans can know about the long-term effects of novel technologies and how we should deal with scientific uncertainty. If we have good reason to believe that nature's processes are stable, safe and work well, and conjointly, we cannot be certain that the ways of reproducing, eating, etc. enabled by science and technology are safe, this might give people reason to be suspicious of the use of 'unnatural' technologies.

Work exploring public attitudes has revealed that ideas about wise nature are held by some members of the public. In Coyle and Fairweather's 2005 work exploring the different associations made by research participants with nature and novel science, it was reported that *"... focus group participants placed a great trust in the all-pervading wisdom of nature... and used it as a moral frame of reference for decision-making on the acceptability of novel biotechnologies."*[109]

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[108] Bostrom N and Sandberg A (2008) The wisdom of nature: an evolutionary heuristic for human enhancement, in *Human enhancement*, Savulescu J, and Bostrom N (Editors) (Oxford: Oxford University Press).

[109] Coyle F and Fairweather J (2005) Space, time and nature: exploring the public reception of biotechnology in New Zealand *Public Understanding of Science* **14(2)**: 143-61.

Views on the wisdom of nature seem to present in discussions on number of areas of science and medicine, including assisted reproduction, genetic modification of plants, animals and people, food and farming, cloning, and complementary and alternative medicine.

The review of public debate, alongside evidence from the literature review on public perspectives revealed that nature is often personified when discussed in the context of discussion of science, technology and medicine, and this regularly happens in a way that superficially suggests that nature has knowledge in which we should place trust. A number of examples carry an implication that nature is able to exercise agency or intentional action, by suggesting that nature sometimes designs, selects, excludes, seeks to do things, or is something on which people should rely.

There were a number of such cases which seem to appeal to intentional states, particularly in contexts discussing fertility and assisted reproduction:

> *"But I think it shows that we need to have a bit more respect for **nature**, which seems to **know** how hard it is to look after a child when you are older."* (The Daily Mail, 2011)

> *"The other big question, she says, is why women are in need of donor eggs in the first place. "It's because society isn't making it possible for women to have babies naturally at the time **nature intended**."* (The Guardian, 2012)

Genetically modified crops, farming and food was another area in which the natural was discussed in this way:

> *"But Mr Parry stresses a fundamental difference: "With GM crops, the gene is advantageous, so **nature will seek** to preserve the advantage. We're giving our organisms a disadvantage - the inability to reproduce.""* (BBC, 2015)

> *"Howard argued that pests, diseases and parasites should be regarded as 'nature's professors of good husbandry', teaching us how to farm for positive health. "**Nature has never found it necessary to design**… vaccines and serums for the protection of livestock"."* (Soil Association, *Batteries not Included*)

Some examples appealed specifically to the idea of 'Mother Nature' who is largely described as someone to be trusted or relied upon or who furnishes people with things they want or need:

> *"Under normal conditions, a woman is best left to be her own director, behaving in an instinctive and uninhibited way. Only when that is allowed to happen will she get the rush of **Mother Nature's** feel-good cocktail."* (The Daily Mail, 2011)

> *"If **Mother Nature** wanted to do [genetic engineering] **Mother***

> ***Nature*** *would have done it years ago and what I see happening is all for short-term gain*."[110]

Other examples referred to nature having a way, or course, of its own. In the examples these 'ways' were described as ones that humans should not try, or are not able to, overcome:

> *"The plan with GM crops was to reduce costs and environmental impact, but neither of these things seem to be happening, because over time,* ***nature takes its course****, and that was bound to happen," said Kirtana Chandrasekaran, a food campaigner at Friends of the Earth."* (The Guardian, 2010)

> *"We need to start focusing on quality as well as on quantity [in farming] and must* ***stop trying to beat nature at her own game***." (Scottish Parliamentary debate on aquaculture, 2009)

A variation on this idea concerns the notions of stability, balance, and the delicacy of evolved natural systems which might be undermined by 'unnatural' human interventions. Nature might be wise insofar that it is constituted of a complex, highly evolved, balanced system of interacting processes and states, interference with which may lead to destabilisation which could have significant adverse effects on the environment, animals, and people.

The idea that novel science, technology, and medicine may undermine the stability of natural processes or the natural environment is sometimes flagged in public debate by the use of certain kinds of interventionist verbs, including *tampering*, *interfering*, *meddling*, *fiddling, tinkering,* and *working against*. These formulations appear regularly in public debates on science, technology and medicine, and carry disparaging connotations:

> *"I believe that such* ***tampering with nature*** *is hugely retrograde and will damage that society in due course."* (Northern Ireland Assembly debate, 2012)

> *"There is considerable unease about the morality of genetic modification* per se *and its potentially damaging effects on the environment. Some of the moral anxiety stems from discomfort with what is often characterised as '****tampering with nature****', 'playing God' or as 'dangerous and* ***unnatural****'"* (Genewatch UK, 1998, *Genetically Modified Foods: will labelling provide choice?*)

A further category of cases make appeal to scientists' inappropriate intervention in nature by reference to 'playing God':

> *"I'm for a lot of them, [new technologies] but I've got a lot of reservations about answers in the medical field in particular, in*

[110] Ibid.

> *relation to cloning and stuff like that. Messing about with **nature**, reproduction, **playing God**."*[111]

These types of comment sometimes appear to go hand in hand with concerns about our lack of knowledge or understanding about the effects of novel technologies in the future:

> *"The fact is that, for all the blithe rhetoric of the GM companies, **we simply do not know enough** about the potential consequences of tampering with nature."* (The Daily Mail, 2012)

> *"**We don't know enough about it**."*[112]

The idea that nature is wise and 'knows best' is also sometimes connected to a view about the products and processes of nature being benign, gentle, and pure. This might involve the idea that natural substances are either harmless or beneficial to health, or ideas about the safety of relying on natural processes, in health, food, and reproduction.

Areas of medicine, such as complementary and alternative therapies and cosmetic procedures, feature ideas of natural techniques as safer, gentler and benign. In this context what is natural is sometimes viewed as intrinsically less risky or involving lower impact on those using these treatments:

> *"I am a great believer in using not only herbal medicine, but **natural** products from our countryside. There are so many **common-sense** things that most of us grew up with..."* (Parliamentary debate on herbal medicine regulation, 2013)

This idea also features in debates on fertility treatment. It is one of the bases on which the novel technique for assisted conception using Kisspeptin is lauded by some parts of the media, in which contexts it is sometimes described as 'gentler' or 'safer':

> *"Twelve babies have been born using a potentially **safer** way of getting eggs for use in IVF, UK doctors say. The **naturally** occurring hormone, kisspeptin, was used to stimulate women's ovaries to produce eggs."* (BBC, 2014)

These ideas sometimes tie in with ideas about *tradition* and the notion that practices from the past must be safer, since they have endured for long periods of time. A number of examples refer to the passage of time and the age of the processes or techniques in question:

> *"People who tend to go down the herbal medicine route have a lot of confidence, however, because they are dealing with **nature** and*

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111 The Royal Society and Royal Academy of Engineering Nanotechnology Working Group (2004) *Nanotechnology: views of the general public*, available at: http://www.nanotec.org.uk/Market%20Research.pdf.

112 Marcu A, Gaspar R, Rutsaert P *et al.* (2015) Analogies, metaphors, and wondering about the future: lay sense-making around synthetic meat *Public Understanding of Science* **24(5)**: 547-62.

> ***natural*** *products that have been used* ***over the years****. Properly administered, those products do not have side effects and they are not prone to becoming ineffective."* (Parliamentary debate on herbal medicine regulation, 2013)

Within discussions of novel science and food issues, what is natural is sometimes seen as more likely to be safe, healthy, nutritious, and beneficial to health:

> *"Issues such as BSE and genetic modification have had a dramatic impact on how consumers view food* ***safety****, making them wary of assurances and turning many toward unadulterated and* ***natural*** *foods*." (Soil Association, *Organic farming, food quality and human health: a review of the evidence*)

> *"[Synthetic meat] doesn't appear to me like a very* ***healthy*** *meat because it's not in contact with the environment, is not outdoors, in the laboratory it seems very* ***chemical****."*[113]

Ideas about the wisdom of nature clearly play a role in the way that some people view the natural. Particularly, these ideas help to explain why it is that some people object to 'unnatural' technologies and why they take naturalness to be important. According to this view, 'unnatural' interventions are wrong because they give rise to unacceptable or poorly-understood levels of risk to people, animals, or nature. Whilst it is not uncommon for concerns about 'tampering with nature' or 'playing God' to be dismissed as reactionary scaremongering, an alternative interpretation is that these anxieties are really about the eventual consequences of applications of novel science, technology, and medicine, the long-term results of which may be difficult to test, or even impossible to fully understand. Philosopher Tony Coady expresses this point:

> *"A degree of humility about how much we know needs to go hand in hand with a frank regard for the uncertainty of future developments consequent upon the application of our present knowledge or theorizing."*[114]

These expressions may in this way convey a perfectly understandable and sensible perspective on the risks attached the use of novel science, technology, and medicine.

Nevertheless, whether or not it is reasonable to assume that relying on evolved, natural processes and defaulting to the use of natural products, techniques and systems, is safer and better for us in the long run remains an open question.

Nature, personification and design

The expression 'wisdom of nature' might suggest a commitment to the existence of a mysterious 'directedness' of natural processes towards what is safe, stable, and

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[113] Ibid.

[114] Coady T (2009) Playing god, in *Human enhancement*, Savulescu J, and Bostrom N (Editors) (Oxford: Oxford University Press).

beneficial; or even to a kind of supernatural force at work. However, people concerned about these issues do not necessarily believe that there is a being (nature) who uses wisdom to design, create and sustain the world, in the way that a supernatural being or God might.[115] Instead, these ideas may be linked to views about the complexity of natural systems and other highly-evolved, interconnected processes and relationships which make up natural organisms and the wider natural world. 'Unnatural' interventions may be ones that pose dangers to these structures.

Nevertheless, the idea that nature's processes are reliable, dependable, and safe is often expressed in formulations of language that personify nature, in apparently assigning understanding, intentions, and design, such as 'nature knows best' or 'Mother Nature'.

An intuitive way of understanding these ideas is by appeal to the notion of metaphor. Linguist George Lakoff and philosopher Mark Johnson stress the prominent role of metaphor in language, arguing that personification *"allows us to comprehend a wide variety of experiences with nonhuman entities in terms of human motivations, characteristics and activities"*.[116] Personifying phenomena which are otherwise difficult to comprehend yields an explanatory framework within which we can confer positive or negative, constructive or destructive, features or charactersitics onto the process or entity described.[117] Describing nature in this way may be one means by which people attempt to understand and communicate a range of interlinked ideas about complexity, stability, fragility, and danger relevant to these debates.

Some of the examples above appeal to the idea of nature as involving something akin to design. This applies both to what nature has designed (for example, the 'ideal' model of reproduction involving a mother and father, as well as humans being designed to eat natural, raw food) and to what nature has not designed (unnecessary vaccines for the protection of livestock). In each case the suggestion is that *"nature does not make mistakes"*.

This is an idea that can also be found within the work of scientists: for example, in the writing of evolutionary biologists:

> *"Biologists have found that selection has routinely produced exquisitely engineered biological machines of the highest order at all scales, from genetic error correction and quality control in protein assembly to photosynthetic pigments, the immune system, efficient bee foraging algorithms, echolocation, and color constancy systems. Indeed, the best-studied psychological adaptation – the eye and visual system – has been held up for centuries as the*

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115 The role of religious belief in these debates is discussed in section 4.6.

116 Lackoff G and Johnson M (1980) *Metaphors we live by* (Chicago: University of Chicago Press).

117 One example discussed by Lackoff and Johnson is monetary inflation. They argue that personifying inflation enables us to efficiently convey a range of features of what for many is an otherwise hard-to-understand phenomenon: "*When we are suffering substantial economic losses due to complex economic and political factors that no one really understands, the INFLATION IS AN ADVERSARY metaphor at least gives us a coherent account of why we're suffering these losses".*

apotheosis of engineering excellence, as yet unrivaled by any human engineer."[118]

Many philosophers and scientists challenge this idea, however, pointing out that the order and stability of the natural world, supposed to support wisdom of nature arguments, is exaggerated. Those who believe in the wisdom of nature, it is said, overlook many aspects of the natural world which, had they been created intentionally, would in fact be regarded as examples of poor design.

In the section of his book *Better than human* called 'Suboptimal design: it's everywhere', philosopher Allen Buchanan lists a number of nature's 'design flaws,' including the blind spot in the eyes of vertebrates, dual function of the human pharynx which significantly increases the chance of death by choking, poor drainage in primate sinuses which gives rise to pain and infection, as well as a number of others. He claims that:

"... It is ironic that proponents of the master engineer analogy invoke natural selection, because it's the imperfection *of biological design that led Darwin to the theory of natural selection in the first place..."*[119]

Buchanan cites Darwin's own view on *"the clumsy, wasteful, blundering, low, and horribly cruel work of nature."* These cases are, Buchanan argues, not simply exceptions or *"the occasional results of Mother Nature having a bad day"* but instead are entirely predictable results of evolutionary processes and seeing them as 'errors' results from simplified conception of the 'ends' of evolution and a confusion about how evolutionary processes operate.

The idea that evolution functions to improve the world and furnish it with good or better states of affairs may simplify the way evolutionary processes actually work.[120] Evolutionary fitness is not a feature which necessarily conduces to the well-being of the fit organism. In natural selection, it is the propagation of the gene that confers evolutionary advantage and determines fitness, and this is compatible with very negative effects on organisms themselves. Edward O. Wilson, for example, emphasises the secondary nature of the individual when considered within evolutionary processes: *"in evolutionary time, the individual organism counts for almost nothing... Its primary function is not even to reproduce other organisms; it reproduces genes, and serves as their temporary carrier."*[121]

This is why there are species whose success as a whole does not equate to goodness for the members of the species. The male honey bee, for example, cannot

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118 Tooby J and Cosmides L (2010) The evolutionary psychology of the emotions and their relationship to internal regulatory variables, in *Handbook of emotions*, Lewis M, and Haviland-Jones JM (Editors) (New York: The Guilford Press).

119 Buchanan A (2011) *Better than human: the promise and perils of enhancing ourselves* (Oxford: Oxford University Press).

120 Ibid. Buchanan argues that this is borne of a confusion about what 'optimality' means within the context of evolutionary theory: "…*optimal doesn't mean best; it means most conducive to reproductive fitness. To say that a trait increases reproductive fitness is just to say that having it increases an organism's chance of passing on its genes to its descendants*", pp45-6.

121 Wilson E (1975) *Sociobiology: the new synthesis* (Cambridge, MA: Harvard University Press).

survive his only function (mating with a queen bee) and *"literally explodes his internal genitalia into the genital chamber of the queen and quickly dies"*.[122] At the end of the summer mating season, any drones which have not mated with queens are driven out of the hive and are left to die of starvation. What is *natural* for the drone is not necessarily *good* for the drone.

From an evolutionary perspective, such examples make sense since it is easy to see how a species might increase its fitness by containing members that, having reproduced, die earlier, thereby leaving their offspring with access to a larger share of the available resources. Biological life involves what philosopher Tim Lewens refers to as *"trade-offs between self-maintenance and reproduction"*[123] and fitness in a particular species may involve prioritising reproductive fitness over self-maintenance.

This means that evolutionary fitness is compatible with considerable suffering and may do little to establish or advance the well-being of individual organisms. Where humans and animals are concerned, in particular, it might be suggested that there is nothing that commits us, ethically, to deference to natural processes giving rise to such unpleasant effects. Bioethicist Julian Savulescu has expressed this point:

> *"Nature doesn't have a goal of good people or flourishing people or happy people. It just creates human beings who live long enough to reproduce, to pass on their genes to the next generation."*[124]

This line of argument concerns the relationship between the complexity of an individual organism and its well-being. It suggests that making assumptions about the superiority of naturally-determined outcomes – the conduciveness of evolutionary processes to give rise to good, or best, states of affairs for people, animals, and the environment – may not be justified.

A related point concerns instances of evolutionary 'dead-ends' which do not appear well-designed, even at the level of the species. Some organisms evolve traits that enable them to out-compete competitors but from which they cannot evolve further and which ultimately lead to their extinction. Nick Bostrom describes this as **"***entrapment in local optimum"*:

> *"Evolution sometimes gets stuck on solutions that are locally but not globally optimal. A locally optimal solution is one where any small change would make the solution worse, even if some big changes might make it better."*[125]

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[122] Ibid.

[123] Lewens T (2015) The risks of progress: precaution and the case of human enhancement, in *The biological foundations of bioethics*, Lewens T (Editor) (Oxford: Oxford University Press)

[124] ideas.ted.com (19 February 2014) *"As a species, we have a moral obligation to enhance ourselves"* available at: http://ideas.ted.com/the-ethics-of-genetically-enhanced-monkey-slaves/.

[125] Bostrom N and Sandberg A (2008) The wisdom of nature: an evolutionary heuristic for human enhancement, in *Human enhancement*, Savulescu J, and Bostrom N (Editors) (Oxford: Oxford University Press).

One example of this might be the phenomenon of parthenogenesis in which species reproduce asexually. Such species are produced by evolutionary forces, but do not have good survival prospects. Biologist Robert Vrijenhoek explains that:

> *"Asexual species are often considered evolutionary dead ends because of their presumed genetic inflexibility. Among vertebrates and insects only 0.1% to 0.2% of species are strictly asexual. This rarity suggests a 'mutation/selection-like' balance. New asexual lineages arise infrequently and go extinct rapidly."*[126]

If unnatural interventions are wrong, then it seems it cannot simply be in virtue of the fact that they alter the uniformly positive products of evolutionary processes governed by a 'wise nature,' since we do not think that all these natural processes and products are, in themselves, good.

Natural stability, hubris and uncertainty

Even if nature does not *always* function to provide good or stable states of affairs, that does not mean that it never does. The nature of this stability and order may also not always be visible at local levels. Some express concerns that certain kinds of technological innovation which appear to be superficially safe, useful human improvements to the world – such as, for example, the introduction of disease-resistant genetically modified crops to natural ecosystems – may have unpredictable outcomes and long-term, negative consequences.

This thought may also underlie concerns about 'playing God', which are not necessarily linked to religious belief. Theologian Ted Peters, for example, has argued that the God invoked when people complain of scientists 'playing God' is really something closer to a *"deified nature*".[127] Those who criticise unnatural interventions using this expression may be objecting to what they perceive to be an improper human desire to alter and control processes of which they have only partial understanding and over which they have limited control.

> *"The non-religious can make sense of the accusation [of 'playing God'] by thinking of the attributes that God would possess if there were a God... The God of natural theology (and of many monotheisms) is omnipotent, omniscient, and supremely benevolent. By contrast human beings are eminently fallible, limited in power, and only partially benevolent."*[128]

These ideas involve caution about hubris, which may result in negative or even catastrophic effects and the need to acknowledge the limitations of human knowledge.

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126 Vrijenhoek RC (1994) Unisexual fish: model systems for studying ecology and evolution *Annual Review of Ecology and Systematics* **25**: 71-96.

127 Peters T (2006) Contributions from practical theology and ethics, in *The Oxford handbook of religion and science*, Clayton P (Editor) (Oxford: Oxford University Press), pp372–87.

128 Coady T (2009) Playing god, in *Human enhancement*, Savulescu J, and Bostrom N (Editors) (Oxford: Oxford University Press).

A well-known expression of this idea can be found in the work of chemist James Lovelock, whose Gaia hypothesis holds that the earth and its contents function as a single, integrated, and self-regulating system.[129] According to Gaia theory, there are reasons to believe that complexity and balance may be upset in unpredictable ways by interventions that appear to be safe or low risk in the short-term. Writing in 1970 on the long-term effects of cultivating the continental shelves, Lovelock argues that what may appear innocuous interventions may be damaging in the far-future, in ways that we could not appreciate now:

> *"This danger is of no conceivable contemporary significance; indeed it would take tens of thousands of years, or even more, to diminish oxygen in the atmosphere to any appreciable extent. Nevertheless oxygen regulation is a key Gaian process and the fact that it occurs on the continental shelves of the Earth emphasizes their singular importance. Knowing or perhaps even suspecting as much as we do now, it seems unwise to tamper with these regions."*[130]

Tony Coady discusses a real-world case which demonstrates *"the perils of well-intentioned motives that ignore or underestimate the limits of our capacities with respect to knowledge, power and benevolence."*[131] The introduction in 1935 of cane toads to Australia as a means of minimising sugar cane pests had very negative effects on Australian ecosystems. In the absence of natural predators, the population of toads, poisonous to most Australian wildlife, increased at a very high rate which was difficult to control.

A well-known example that demonstrates a similar point is the prescription of the drug Thalidomide in the 1950s and 1960s. The drug was initially thought to be a safe treatment for pregnant women experiencing morning sickness and insominia but was withdrawn from sale in the UK in 1961 after babies were born with missing or shortened limbs. However, Thalidomide, had passed tests which, at the time, were thought to have established its safety. Dosages of over 600 times that standardly prescribed for humans had no effect on rodents[132] and tests on pregnant animals were not legally required at the time. However, when further experiments were subsequently conducted on pregnant rabbits, mice, rats, hamsters, macaques, marmosets, baboons and rhesus monkeys, similar effects in offspring were observed. The Medicines Act of 1968 was, in part, a response to the problems caused by Thalidomide.

Many of the examples from our review refer to the limits of our understanding by appeal to *'unforeseen consequence'* and the fact that *'we simply do not know enough about the consequences'*. These ideas are represented frequently in public perspectives, wherein people express worry that scientists' confidence about the long-term safety of scientific techniques is not justified.

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[129] Lovelock J (1970) *Gaia: a new look at life on earth* (Oxford: Oxford University Press).

[130] Ibid.

[131] Coady T (2009) Playing god, in *Human enhancement*, Savulescu J, and Bostrom N (Editors) (Oxford: Oxford University Press)

[132] BBC News (14 January 2010) *Apology to thalidomide survivors*, available at: http://news.bbc.co.uk/1/hi/health/8458855.stm.

The idea of 'playing God' effectively conveys ideas about inappropriate intervention in the absence of knowledge, and abuse of power. Scientists, doctors, and geneticists might be described as 'playing' by those who believe that, like children, they do not fully understand what they are doing. Unlike an actual god, they lack the power and knowledge necessary to foresee or control the effects of their actions. Mary Midgley points out that it is these pretensions to power and knowledge that explain the use of this expression:

> *"That phrase, which defenders of the projects have repeatedly dismissed as mere mumbo jumbo, is actually a quite exact term for the sort of claim to omniscience and omnipotence on these matters being put forward."*[133]

Some writers have drawn parallels between this kind of behaviour and the legend of Prometheus who, in Greek mythology, created man. Science writier Philip Ball sets out how the distinction between acceptable and unacceptable scientific intervention may be cast using this myth:

> *"The engineer is usually a humble fellow, narrowly goal-oriented, content to tinker with stolid diligence until he (it is usually a he) gets the bridge built or the machine running. But when he abandons his humility when he attempts to soar, to exceed the limits that his skill and judgement ought to properly impose, then he becomes mythical. Then he becomes a Prometheus."*[134]

Exceeding limits imposed by human skill and judgment may give rise to problems further down the linein the future.

Precautionary approaches

Related ideas are plausibly part of the rationale for adopting the precautionary principle, a version of which is embodied in legal and regulatory policy in the European Union. The precautionary approach – related to the idea that science and policy interventions should first and foremost 'do no harm' – was initially proposed within the context of environmental protection in the 1970s. An early exposition of these ideas came from economists Kenneth Arrow and Anthony Fisher:

> *"The existence of uncertainty will in certain important cases, lead to a reduction in net benefits from an activity with environmental costs. In such cases the implications for an efficient control policy will generally involve some restriction of the activity."*[135]

Different formulations of the precautionary principle have developed over time and precautionary considerations are now used to support decision-making on a range of issues relating to the regulation of novel science, technology, and medicine in cases of scientific uncertainty. Precautionary approaches tend to place the burden of proof

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133 Midgley M (2000) Biotechnology and monstrosity: why we should pay attention to the "yuk factor" *The Hastings Center Report* **30(5)**: 7-15.

134 Ball P (2012) *Unnatural: the heretical idea of making people* (London: Vintage).

135 Arrow KJ and Fisher AC (1974) Environmental preservation, uncertainty, and irreversibility *The Quarterly Journal of Economics* **88(2)**: 312-9.

on those who propose that the use of novel scientific techniques is safe. The principle can also be used to monitor, regulate, reduce or even prohibit interventions in cases where there is doubt over their likely effects.

The precautionary principle features in Article 191 of the Treaty on the Functioning of the European Union. It aims at securing "*a higher level of environmental protection through preventative decision-taking"*, though the European Commission describes the scope of the principle as broader than this, bearing also on "*consumer policy*" and *"European legislation concerning food and human, animal and plant health*."[136] The European Commission explains that the principle can be employed in circumstances in which there is inadequate information about risks:

> *"The precautionary principle enables rapid response in the face of a possible danger to human, animal or plant health, or to protect the environment. In particular, where scientific data do not permit a complete evaluation of the risk, recourse to this principle may, for example, be used to stop distribution or order withdrawal from the market of products likely to be hazardous*."[137]

One candidate 'real world' example of an appeal to the principle was in the public and political debate surrounding genetically modified organisms in the UK in the late 1990s. The principle appeared to form one of the primary bases of argument for restricting the cultivation of genetically modified organisms in the UK. For example, the position statement issued by UK conservation agency, English Nature (now Natural England) on potential impacts on biodiversity in the UK stated that:

> *"The environmentally untested introduction of GMOs could be the final blow for such species as the skylark corn bunting and the linnet, as the seeds and insects on which they feed disappear. We must adopt the precautionary principle if we are to maintain England's biodiversity – its wealth of wildlife – and honour Government's commitments under the Rio Convention."*[138]

The precautionary principle is not without its critics, however. One concern centres on the lack of clarity over what particular measures it may require in a given situation. This point is observed in the Nuffield Council's 1999 report *Genetically modified crops: the ethical and social issues*, in which consultation responses relating to the precautionary principle were described the following way:

> *"… The precautionary principle may be understood as a reminder that human beings are all too easily carried away by excitement and novelty, and need to be warned against hubris. However, other respondents have treated the precautionary principle as a distinctively moral principle, which emphasises the intricacy of the natural world and which urges us to take that intricacy with proper*

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136 EUR-Lex (2000) *The precautionary principle*, available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:l32042.

137 Ibid.

138 Gilland T (2000) Precaution, GM crops and farmland birds, in *Rethinking risk and the precautionary principle*, Morris J (Editor) (Oxford: Butterworth-Heinemann).

> *seriousness. Understood in either of these ways, the principle does not yield very definite prescriptions, but does urge caution upon scientists, governments and farmers."*[139]

As suggested by the opinions above, the precautionary principle does not seem able, on its own, to settle debate about how to balance distinct and competing risks associated with new technologies.

A separate issue relates to the very high threshold that certain versions of the principle seem to place on the degree of confidence required to justify the use of novel science, technology, and medicine.

In analysis of another 'real-life' example, Tim Lewens appraises this kind of objection to the use of novel technologies for human enhancement. He considers the British Medical Association (BMA)'s 2007 position on Modafinil, a drug which – some evidence suggests – may improve human performance in certain cognitive tasks. The BMA's statement on the drug at the time was that:

> *"... Although the pharmaceutical products produce interesting and promising results in ideal laboratory conditions, their impact in less controlled situations is still to be investigated. In the meantime, there are risks in attempting to extrapolate from small scale studies... It must also be strongly emphasised here that the side-effects of taking the drugs, particularly over a prolonged period, are unknown and may turn out to be problematic."*[140]

Lewens points out that the precautionary stance adopted here seems to be grounded on the gap that may exist between what is observed in the laboratory, or within small-scale studies, and what may happen with wider use in real life scenarios, alongside doubts about long-term side effects. However, these risks, he suggests, are not distinctive to novel enhancing technologies, and may exist in the case of many widely-used, uncontroversial medical techniques and treatments:

> *"These things can always be said, even of very well-established therapeutic technologies whose documented benefits are considerable and whose recorded side effects are negligible. Even in these cases one might point out that an inference to their general safety and efficacy is not watertight. But we do not conclude that precautionary restrictions should be placed on well-established therapies merely because it is consistent with our evidence that they might go wrong."*[141]

Bioethicists John Harris and Søren Holm consider the same issue within a broader discussion of precaution, longevity and the ethics of using medical technologies to significantly increase the natural human lifespan. One of their suggestions is that this strong stance on precaution may arise from deployment of a particular notion of

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139 Nuffield Council on Bioethics (1999) *Genetically modified crops: the ethical and social issues*, available at: http://nuffieldbioethics.org/wp-content/uploads/2014/07/GM-crops-full-report.pdf.

140 Lewens T (2015) The risks of progress: precaution and the case of human enhancement, in *The biological foundations of bioethics*, Lewens T (Editor) (Oxford: Oxford University Press).

141 Ibid .

possibility, arguing that the 'risk' of a technology resulting in harm is not meaningful if this is construed as a merely *logically possible* outcome. The fact alone that it is conceivable that something may go wrong does not count as evidence of the *"real possibility"* of harm. They argue:

> *"It is logically possible for pigs to fly (i.e., it entails no logical contradiction), but it is clearly not possible in the everyday sense of the word... what the PP asks us to do is to suspend this distinction when it comes to possibility of certain kinds of harm and act as if the mere fact they are logically possible also means that they are not only possible, but even likely to occur."*[142]

Interpretating the requirements of a precautionary approach in such a strong way could have significant effects on the rate of technological progress. As economist Julian Morris has argued, if the principle is used to impose too high a threshold on confidence of safety, this is likely to have negative impacts on society more broadly.

> *"… It is impossible to demonstrate the absence of harm: regardless of how thorough is one's assessment of a technology, it is always possible to miss possible harms. Taken literally, this would effectively shut down civilisation."*[143]

A related and important concern is the use of the principle as an effective veto on potentially important technologies that may stand to benefit individuals or groups remote from decision-makers and those influencing them.[144] The Nuffield Council made this point, in *Genetically modified crops: the ethical and social issues*, highlighting potential injustices that could arise as a result. The Council stated that it *"would not wish concerns about very small risks to the inhabitants of developed countries to inhibit the R&D that can benefit the inhabitants of the poorer world."*[145]

A further point on caution and risk concerns an inclination to see omission as less risky than action: when decisions about the introduction of novel scientific techniques are being considered, it may appear that 'doing nothing' is safer. However, 'doing nothing' will also give rise to a particular set of consequences, the nature of which may also be hard to determine and especially in complex cases, "*we will typically find that all courses of action carry potential, albeit unconfirmed, possibilities for causing significant harm*".[146] A similar point may apply to inaction and hubris. Tony Coady has pointed out that:

> *"A conservative stance on innovation is often seen as necessarily less prone to the assumptions of omniscience, omnipotence, and omnibenevolence. But this does not ring entirely true. The attitudes*

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142 Harris J and Holm S (2002) Extending human lifespan and the precautionary paradox *The Journal of Medicine and Philosophy* **27(3)**: 355-68.

143 Morris J (2000) *Rethinking risk and the precautionary principle* (Oxford: Butterworth-Heinemann).

144 Sunstein C (2002) *The paralyzing principle: does the precautionary principle point us in any helpful direction?*, available at: http://object.cato.org/sites/cato.org/files/serials/files/regulation/2002/12/v25n4-9.pdf.

145 Nuffield Council on Bioethics (1999) *Genetically modified crops: the ethical and social issues*, available at: http://nuffieldbioethics.org/wp-content/uploads/2014/07/GM-crops-full-report.pdf.

146 Lewens T (2008) The art of medicine: taking sensible precautions *Lancet* **371(9629)**: 1992-3.

involved in playing God can easily enough find a home in the defence of the status quo.*"*[147]

The broader question about how to understand scientific uncertainty is a topic which has been explored by a number of science organisations, including Sense About Science in their 2014 report *Making sense of uncertainty*; and by the Royal Society in a multidisciplinary meeting in 2010.[148]This work reflects the fact that scientists tend to be comfortable with the idea of uncertainty and, when questioned on the topic, stress the fundamental role that uncertainty plays in science.

"Uncertainty is normal currency in scientific research. Research goes on because we don't know everything. Researchers then have to estimate how much of the picture is known and how confident we can all be that their findings tell us what's happening or what's going to happen. This is uncertainty."[149]

This also appears to be the view of several individual scientists. Nobel prize-winning biologist Sir John Sulston, for example, has stressed the positive force that uncertainty plays in science. He argues that science *"continue*[s] *from era to era of growing understanding, always with uncertainty at the leading edge*.*"*[150]

The consequences of being uncertain in this more limited, scientific sense may, then, not justify strong resistance to the use of novel technology. But it is, of course, possible to reframe the question from 'are we certain?' to 'are we certain *enough*?' What level of uncertainty should we be ready to tolerate when assessing the acceptability of using new technologies to alter the natural world?

How, precisely, uncertainty about unintended consequences should be factored into science and policy decision-making is likely to depend substantially on the particular features of a given case, levels of risk, and what is at stake. In certain cases, especially when the stakes are very high, we may not be prepared to accept higher levels of uncertainty. A team of academics, including the philosopher Carl Friedrich Gethmann, point out that sometimes more intrusive measures may need to be taken in response to risk:

"Interventions should be proportional to the chosen level of protection and the magnitude of possible harm. Some definitions call for 'cost effective measures' or make some other reference to costs, while others speak only of prevention of environmental damage. Costs are only one consideration in assessing proportionality. Risk can rarely be reduced to zero. A total ban may not be a proportional response to a potential risk in all cases.

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147 Coady T (2009) Playing god, in *Human enhancement*, Savulescu J, and Bostrom N (Editors) (Oxford: Oxford University Press).

148 The Royal Society (2010) *Handling uncertainty in science,* available at: https://royalsociety.org/events/2010/uncertainty-science/

149 Sense About Science (2013) *Making sense of uncertainty*, available at: http://www.senseaboutscience.org/resources.php/127/making-sense-of-uncertainty.

150 Science Media Centre (2012) *Communicating uncertainty in a soundbite*, available at: http://www.sciencemediacentre.org/wp-content/uploads/2012/09/Communicating-Uncertainty-in-a-Soundbite.pdf.

> *However, in certain cases, it is the sole possible response to a given risk."*[151]

Lewens has also argued that, in the context of enhancement *"it is crucial to recognise that not all interpretations of precaution are incoherent... and there are legitimate precautionary concerns that apply to enhancement technologies."*[152] These are concerns, he suggests, that do not rely on the *"abstract possibility"*[153] that evidence is false or misleading, but rather on considerations relating to, amongst other things, the *"overall value"*[154] of an intervention and the *"cost-benefit ratio"*[155] that a technology offers.

In the Nuffield Council's 2011 report *Biofuels: ethical issues,* similar observations are made and the Council advocates a *"comparative or moderate version* [of the principle] *that calls for a case-by-case analysis of a development in terms of its risks and benefits, and the costs of its consequences."*[156] More broadly, it seems likely that accommodating facts about the benefits of novel science, technology, and medicine – and being sensitive to potential interests or biases that may bear on appraising these factors – should be a part of this process.[157] It is also worth observing that the degree of unnaturalness of a technology (i.e. the further it deviates from what is found in nature) will not necessarily be the best guide to the outcomes of these risk assessments.

Risk and uncertainty concerning long-term effects are important considerations when appraising the appropriate levels of precaution with which we should treat novel science, technology, and medicine. Also important for ideas linked to caution over 'unnatural' technologies are questions concerning the desirability or value of what these technologies may be able to achieve. This is referred to in *Emerging biotechnologies: technology, choice and the public good* as *ambiguity*.

> *"Even if the outcomes of various commitments to biotechnologies could be predicted with reasonable confidence these may still be understood and valued differently from different perspectives or in different contexts."*[158]

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151 Gethmann C, Carrier M, Hanekamp G *et al.* (2014) *Interdisciplinary research and trans-disciplinary validity claims* (Cham, Switzerland: Springer).

152 Lewens T (2015) The risks of progress: precaution and the case of human enhancement, in *The biological foundations of bioethics*, Lewens T (Editor) (Oxford: Oxford University Press).

153 Ibid.

154 Ibid.

155 Ibid.

156 Nuffield Council on Bioethics (2011) *Biofuels: ethical issues*, available at: http://nuffieldbioethics.org/wp-content/uploads/2014/07/Biofuels_ethical_issues_FULL-REPORT_0.pdf.

157 The more general assessment of risk appears also to be how the European Union construes legitimate appeal to the principle stating that "...recourse to the principle belongs in the general framework of risk analysis (which beside risks evaluation, includes risk management and risk communication) and more particularly in the context of risk management..." See: EUR-Lex (2000) *The precautionary principle*, available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:l32042.

158 This view is reflected elsewhere in the Council's work, including its recent evidence to the House of Lords Science and Technology Committee's Genetically modified insects inquiry, in which it was explained that the Council avoids appeal to the precautionary principle "except to explain that

We may have reason to be cautious about the use of these technologies, not simply because the outcomes of their use are hard to predict, but because there may be disagreement about whether these outcomes would be good or bad. This problem may apply even in cases where there is more confidence about likely effects since the challenge will remain of "*reaching a coherent understanding or evaluation of the prospects, practices or products*" [159] of a given piece of science or technology. An appropriate stance on precaution should therefore take into account considerations about the challenge of appraising the value of change brought about by scientific intervention, as well as calculating more factual or descriptive accounts of their effects.

Nature as benign and gentle

Evidence from our review of public debates and review of public perspectives on naturalness suggests that some people view natural products, in food, cosmetics or medicine, as safer, healthier, and more wholesome. Natural things are also often seen to be benign, whereas unnatural things are more likely to exert (largely negative) effects.

Psychologist Paul Rozin's work in this area reveals that, amongst members of the public, natural things are often thought to be healthier, more appealing, or less abrasive to the environment than those that are not natural. This effect was more pronounced for food than in medicines:

> *"... Healthfulness is often given as a reason for preferring natural foods, even when healthfulness or effectiveness (for medicines) of the natural and artificial exemplars is specified as equivalent, the great majority of people who demonstrate a preference for natural continue to prefer natural."*[160]

One particular area where associations are made between what is benign and harmless is within the context of the organic food movement. Organic food is often marketed using appeal to nature and is perceived by many to be both better for the environment, and healthier or more nutritious for those who eat it, in virtue of its naturalness. There are many brands which include the word *nature* or *natural* in their names, including Eat Natural and the Natural Grocery.

Organic farming practices are supported by a range of organisations which campaign on environmental issues, such as the Soil Association and Friends of the Earth, and aim to minimise impact on the natural environment. The Food and Agriculture Organization of the United Nations cites some of the positive the environmental effects of organic agriculture on sustainability, biodiversity, soil, air

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it does not use it, but it still wants to hold on to the idea of proceeding with caution and in a measured way." (*Revised transcript of evidence taken before The Select Committee on Science and Technology Inquiry on Genetically Modified Insects* (2015))

[159] Nuffield Council on Bioethics (2012) *Emerging biotechnologies: technology, choice and the public good*, available at: http://nuffieldbioethics.org/wp-content/uploads/2014/07/Emerging_biotechnologies_full_report_web_0.pdf.

[160] Rozin P, Spranca M, Krieger Z *et al.* (2004) Preference for natural: instrumental and ideational/moral motivations, and the contrast between foods and medicines *Appetite* **43(2)**: 147-54.

and water, stating, for example, that *"in some areas where pollution is a real problem, conversion to organic agriculture is highly encouraged as a restorative measure (e.g. by the Governments of France and Germany)."*[161] Some may believe that organically produced food is more natural, and thereby better, than that which is produced using industrialised farming techniques.[162]

The connection between organic food and healthiness is, however, subject to challenge. Molecular biologist Lee Silver, for example, resists this assumption and has argued against the idea that organic food is any better for those who consume it than food produced using other techniques.

> *"The organic food industry has grown by leaps and bounds in recent years because consumers equate organic with "natural," and "natural" with healthy and safe. But organic food is just as likely (if not more so) to be tainted by pathogenic bacteria, and organic peanuts and soy are just as likely to cause allergic reactions that lead to death... the total number of negative health consequences to American consumers from synthetic pesticides and "artificial flavors, colors, or preservatives" is – by all estimates – zero."*[163]

Not all defenders of organic agriculture accept these claims, however. The Soil Association argues that *"it is clear that organic farming delivers real differences in nutrients between organic and non-organic crops",*[164] citing a recent meta-anlaysis which found that organic crops, and food made from them, are higher in antioxidants than non-organic food.[165] There is ongoing debate about whether organic food is of greater benefit to health than non-organic food.[166]

There are, nevertheless, a number of counter examples to the idea that the produce of nature is uniformly benign. Many substances found in nature are highly toxic and very harmful to human beings. In its 2014 report, *Making sense of chemical stories*, Sense about Science notes:

> *"... Untreated water can kill, and poor food hygiene can result in toxins that make people very ill, yet these are all natural*."[167]

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161 See: Food and Agriculture Organization of the United Nations (2015) *FAQs*, available at: http://www.fao.org/organicag/oa-faq/oa-faq6/en/.

162 Meta analyses have shown that organic food practices have generally positive impacts on the environment per unit of area, though questioned whether this applies to product units. For a discussion, see: Tuomisto HL, Hodge ID, Riordan P and Macdonald DW (2012) Does organic farming reduce environmental impacts? – A meta-analysis of European research *Journal of Environmental Management* **112**: 309-20.

163 Silver L (2007) *Challenging nature: the clash between biotechnology and spirituality* (New York: Harper Perennial).

164 Soil Association (2015) *Organic nutrition*, available at: http://www.soilassociation.org/whatisorganic/organicfood/organicnutrition.

165 Barański M, Średnicka-Tober D, Volakakis N *et al.* (2014) Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses *British Journal of Nutrition* **112(5)**: 794-811.

166 BBC News (4 September 2012) '*Organic food 'not any healtier'*, available at: http://www.bbc.co.uk/news/health-19465692

167 Sense About Science (2014) *Making sense of chemical stories*, available at: http://www.senseaboutscience.org/pages/making-sense-of-chemical-stories.html.

Within the field of complementary and alternative medicine, the idea of 'gentle' natural products also prevails. Coyle and Fairweather's work on public perspectives indicates that nature is sometimes perceived to be a *"herbal dispensary"*[168] and our own review of public debate revealed views that natural remedies *"do not have side effects"* and reports that people avoided *"strong drugs"* in favour of making use of *"natural, alternative therapies"*.

Rosalind Coward, a professor of journalism whose book on alternative health explores the explosion of complementary and alternative medicine in the late 1980s, has examined these ideas in the context of the field of 'natural health', observing:

> *"Natural therapies are regularly promoted as being safe, gentle, kind to the body, and working with the body; they are not as dramatic as drugs, because they are gentle and have a more subtle approach they sometimes take longer to work."*

She explains that the natural is a key idea within this field, noting that *"'Nature' is probably the most important concept in the alternative health movement. To claim that a therapy, medicine or food is 'natural' is to validate it instantly."*[169]

However, there are clear parallels between the debate about alternative medicine and the above discussion of natural and organic foods. Natural remedies, such as St. John's Wort, are known to have adverse side effects and can interact in negative ways with other medicines. Writing on this topic, David Colquhoun, a professor of pharmacology, has noted that:

> *"Plants didn't evolve for our benefit. Natural selection ensures that plants, like every other living thing, evolve in a way that maximises their own chance of survival. To ensure that, plants should be as toxic as possible to anything that might eat them. The more harm a plant does to humans, the better its chance of survival. It is sheer luck that some of the toxic principles evolved by plants occasionally turn out to be useful."*[170]

Coward notes inconsistencies in how people think of the natural with alternative health. Her discussion suggests that the notion of the natural in this field is often confused, and frequently harks back to the romantic idea of a pre-industrialised environment which never existed.

> *"To place science, industry and technology in consistent opposition to nature is to make nature an entirely imaginary place, without any human society. Nature in this fantasy is where you can find elements and substances untouched by human activity, and experience an original wholeness. It is a fantasy which has its roots*

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168 Coyle F and Fairweather J (2005) Space, time and nature: exploring the public reception of biotechnology in New Zealand *Public Understanding of Science* **14(2)**: 143-61.

169 Coward R (1989) *The whole truth: myth of alternative health* (London: Faber & Faber).

170 Colquhoun D (2012) *DC's improbable science page*, available at: http://dcscience.net/improbable.html.

in a hostility to machinery born in the rapid social changes of the Industrial Revolution."[171]

Such views may prejudice the beliefs of those in favour of valuing the idea of eating, drinking, using, and practising 'whole' and 'untouched' natural substances.

Nevertheless, even if some views about natural food and health are based on a romanticised view of pre-industrial nature, this would not show that preferring natural food and medicinal treatments may not be a useful heuristic for avoiding harmful substances. A strong version of the view that natural products are better – that *all and only* natural products are good for us – may not be plausible. But a weaker version, which instead advocates care and caution about the use and consumption of products which have not been exposed to the more practical, long-term tests that accessibility to, and use by, humans over many years yields, *may* be a useful device of practical reasoning. Further, it may still be that such a perspective could turn out to provide a sensible rule-of-thumb for those making decisions about what products to consume and use.

Section summary

Some ideas about naturalness seem to be linked to the notion that there is a *wisdom of nature*.

These views do not need to invoke nature as a metaphysically mysterious entity or a deified being, but may involve one of a number of ideas about the reliability of natural products and processes. In this account of naturalness, relying on natural products or processes is supported by pointing to the stability of natural systems and the seeming suitability of evolved plants and animals for their environments. Concerns about the the limits of human knowledge and scientific uncertainty, and views about precaution, also sometimes underlie warnings about the potential risks of 'tampering with nature'. Ideas about the *wisdom of nature* are also connected to the belief that natural, long-used products are less likely to harm those using them or the environment.

[171] Coward R (1989) *The whole truth: myth of alternative health* (London: Faber & Faber).

4.4 Natural purpose

Ideas about natural purpose concern what people, animals and plants are meant to do or be like, grounded in natural or evolved functions.[172] Some hold the view, associated with the philosopher Aristotle, that there are certain ways of living, which may derive from the natures or essences of beings, which determine what is good or right for those beings. In this picture, unnatural technologies may be wrong because they move people, animals, or plants too far away from their morally significant fundamental nature, which determines how and what they should be.

This idea about purpose and function seems to be present in public debate in a number of areas of science, technology and medicine, including fertility techniques, genetic modification and different kinds of enhancement, including physical, cosmetic and intellectual.

For example, the idea that modern reproduction techniques could be used to enable the selection of embryos with certain characteristics to create 'designer babies' raises ethical concerns about the nature of reproduction and how humans are 'supposed to' reproduce. Similarly, a person who voluntarily chooses to replace their limbs with stronger, better-performing prosthetic limbs may be altering themselves in a way that moves too far away from what is natural for a human being, in spite of the fact that such alterations may significantly increase what they are able to do.

This concern about naturalness and purpose may bear on both the activities and products of science. Using fertility techniques to enable people to have children into older age may overrule naturally imposed and important constraints on when humans are able to reproduce. Similarly, artificially extending life for longer and longer periods is thought to be unnatural by some, who may feel there is a time at which humans are meant to die and to interfere substantively with this undermines our natural way of being.

It may also be thought that there are ways that certain things should 'be'. People may feel that human beings are supposed to have the DNA of two parents and that introducing the DNA of a third person to an embryo, as is the case in techniques to prevent mitochondrial DNA disorders, is therefore morally problematic. The same thought might underlie the belief that cloning, which involves reproduction using just one set of DNA, would be wrong. People may, in a similar way, feel that tomatoes are supposed to be red; or that plants are not meant to contain fish genes.

This is a separate idea to the thought that embarking on these kinds of scientific enterprise is unwise. Whilst those who believe that some science, technology, and medicine is unnatural and wrong because it undermines natural purpose may also be concerned that it carries risks, they need not believe this. Those who are concerned about natural purpose may simply believe that such interventions are wrong irrespective of any negative consequences that they may or may not have.

A number of examples from debates about reproduction, birth, and parenting appear to involve ideas about natural function and purpose.

[172] These are often referred to in academic literature as issues relating to teleology.

> *"Most people will surely regard this as just plain weird, even revolting. This is not prejudice. Such a reaction speaks from an innate feeling about men and women, their* ***roles****, family life, about what is '****natural****'."* (The Daily Mail, 2012).

> *"And in the case of IVF for women over 40, technology is being abused, by extending childbearing beyond the* ***limit*** *set by* ***Mother Nature****."* (The Telegraph, 2013)

Some examples of this kind are connected to farming and food:

> *"Thomas responds: "If people saw the conditions the cows are in, how* ***unnatural*** *the intensive environment is, they'd know it wasn't right. A five-year-old knows cows* ***belong*** *in fields.""* (The Guardian, 2010)

> *"It is a return to the way we were designed to eat. Nature doesn't make mistakes; it gives each species everything it needs in order to* ***thrive****. If we were* ***meant to*** *eat cooked food, we would have been born with built-in ovens!"* (The Guardian, 2014)

Other examples concern issues related to end of life medical treatment, death and dying which imply that there is a 'natural end' to life, or a time at which people are *meant* to die:

> *"... Death is part of life – there could be no meaningful life without it. It is part of the same process, a fluctuation, of death/life. As it is we cast it as* ***unnatural****, even evil – and this is absurd... Because these doctors have the maturity to face the fact that life has a* ***natural end****."* (The Guardian, 2015)

> *"Life has a* ***natural end*** *and there is not necessarily anyone to blame when a patient dies"*[173]

Ideas about natural purpose are closely linked to questions of function, essence or *telos* (as it is described in philosophical terminology). Sometimes this is expressed as the idea that living beings have natures, which are morally significant, and which may be closely connected to what is good for those beings and how they are able to 'flourish'.

The moral relevance of non-human animals' capacity to flourish is considered as one issue within a wider discussion of the ethics of animal experimentation in the Nuffield Council's 2005 report *The ethics of research involving animals*, where it is explained that one:

> *"… basis of moral concern, associated with Aristotle, is the idea of animals having a* telos*, a good, or alternatively having interests or*

[173] Christian Medical Fellowship (1999) *When to withdraw or withhold treatment*, available at: http://admin.cmf.org.uk/pdf/cmffiles/07_witholding_treatment.pdf.

> *species-specific needs. If the animals are able to satisfy these needs, one might say that they* flourish*. This concept enables us to say that things may go well or badly for an animal depending on how specific environmental conditions relate to its usual species-specific development."*[174]

It may be part of an animal's nature that they live in certain kinds of environment, eat certain kinds of food, or reproduce in certain ways. 'Unnatural' environments may be bad for animals living in laboratories, or in farms, since these environmental conditions may undermine their welfare, in frustrating their ability to flourish.

A separate concern about natural functions and roles may also be linked to thoughts about *natural boundaries*. If species are characterised by their unique natures, essences or functions, which are connected to what is good for them, then distinctions between species will be non-arbitrary, morally significant divisions. This may also be part of what concerns people about the use of techniques that transgress these boundaries. The report outlines this concern:

> *"Another extension of the concept of flourishing relates to considerations about the moral value of a* species*. This may be especially relevant to issues raised by selective breeding and the genetic modification of animals. These processes usually aim at altering an aspect of the genotype of a species in a targeted and often unprecedented way."*[175]

Questions about natural boundaries are also discussed in the Council's 1996 report *Xenotransplantation* where much of the debate about naturalness concerns the development of transgenic animals to facilitate the transplantation of animal organs into human beings. This may be thought wrong by some because it interferes with the essence of the species 'pig'.

> *"Some see the production of transgenic animals as an unnatural act that attempts to change the nature of animals and violates species boundaries. According to this view, genes have a particular significance because they contain the information that determines the essence of any one species. To move genes around is to destroy the integrity of species as natural kinds, and to create unnatural hybrids."*[176]

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[174] Nuffield Council on Bioethics (2005) *The ethics of research involving animals*, available at: http://nuffieldbioethics.org/wp-content/uploads/The-ethics-of-research-involving-animals-full-report.pdf, at paragraph 3.37.

[175] Ibid., at paragraph 3.40. However, the report resisted this conclusion, arguing that "..many members of the scientific community would deny that most cases of GM animals are more 'unnatural' than conventionally bred animals, or that the technique compromises the flourishing of animals in new and special ways. They point to the fact that selective breeding of animals dates back to the beginnings of agriculture and domestication, and that it has been used extensively within scientific research; for example, to create inbred strains of genetically identical animals or to sustain scientifically interesting mutations."

[176] Nuffield Council on Bioethics (1996) *Animal-to-human transplants: the ethics of xenotransplantation*, available at: http://nuffieldbioethics.org/wp-content/uploads/xenotransplantation.pdf, at paragraph 4.45.

In the case of people, it is this idea – that human beings have a distinctive and ethically significant human nature – that has a long history and has its roots in the work of Aristotle. For Aristotle the issue of human nature is closely tied to ideas about function, which are themselves connected to what is good for people:

> *"... Just as for a flute-player, a sculptor, or an artist, and, in general, for all things that have a function or activity, the good and the well is thought to reside in the function, so would it seem to be for man, if he has a function."*[177]

Aristotle's view is that man does have a distinctive function – or 'ergon' – and what is good for man is determined by this function. Philosopher Thomas Nagel explains that, according to the Aristotelian view, this function is not just what determines human good, but is also what is distinctive to humans, and is akin to a human essence or nature:

> *"… When something has an ergon, that thing's good is specified by it. The proper ergon of man, by which human excellence is measured, is that which makes him a man rather than anything else."*[178]

Human beings' function therefore is both what is fundamental to being human, and also what determines the good for human beings. It is closely connected to the ways of living that human beings should pursue in order to live well and to flourish. Flourishing for people will depend on the extent to which they live according to their nature and any impediments to acting in accordance with human nature presented by science, technology, and medicine are problematic for those reasons.

Unnatural technologies, then, may raise ethical problems by disengaging people or animals from their ethically significant nature. Additionally, any scientific intervention which threatened to fundamentally alter these essences or natures, through establishing, over time, permanent changes to the essential characteristics of the human race would, on this view, be ones of which we should be wary.

These ideas about natural purpose can overlap with notions about God and religious belief as well as with notions of wisdom and design. Views about the significance of human nature and natural boundaries may derive from views about God as the creator of of human nature, or with the idea that the world and its contents have been designed.

Human nature

There has been much debate about the existence and character of human nature which is relevant to these debates. Contemporary discussion of this topic involves both those who both believe that human nature exists, and is important, as well as those who are sceptical that there is any such thing, or about its importance in debates on novel science, technology, and medicine.

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[177] Aristotle (2004) *The Nichomachean ethics* (London: Penguin Classics).
[178] Nagel T (1972) Aristotle on Eudaimonia *Phronesis* **17(3)**: 252-9.

Philosopher Adam Briggle explores the role that ideas about human nature play in debates on new technologies, and defends the idea that human nature is an important concept in such discussions. Briggle acknowledges the difficulties in relying on appeals to human nature in resolving ethical disputes on bioethics topics, highlighting the fact that these ideas can often reflect reactionary politics or ideologically driven norms. Conceding that conservative theorists often *"uncritically and dogmatically invoke human nature to resist reforms and eternalize class and gender divisions"* he nevertheless maintains that the notion of human nature is integral to the way we think about ethics and politics and should not be ignored:

> *"We cannot avoid normative reasoning from human nature, so the question is not whether to do it but how best to do it…Indeed, a notion of human nature is indispensible for political liberalism. The early modern architects of liberty made human nature their cornerstone as is signified, for example, in the US Declaration of Independence."*[179]

There are a number of other ideas about why we should value human nature. Frances Fukuyama, for example, has argued that the reason we should be concerned about the application of novel science interfering with human nature is because it is what grounds our sense of morality:

> *"Human nature is what gives us a moral sense, provides us with the social skills to live in society, and serves as a ground for more sophisticated philosophical discussions of rights, justice and morality."*[180]

The broad idea that human nature is important because of its connection with our moral sensibilities has also been defended in the continental tradition. Philosopher Jurgen Habermas argues that genetic modification, specifically, raises deep moral questions relating to human nature:

> *"… Only with genetic engineering aiming at selection and at the modification of traits, as well as the research required for such goals and geared to future genetic treatment… do challenges of a new order arise. They imply the licence to control the physical basis which "we are by nature"… this extension of control of our "inner" nature is distinguished from similar expansions of our scope of options by the fact that it "changes the overall structure of our moral experience."*[181]

It is in virtue of these implications for our overall moral experience that, Habermas argues, we have good reason to *"proceed with caution"*.[182]

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[179] Briggle A (2010) *A rich bioethics: public policy, biotechnology, and the Kass Council* (Notre Dame, Indiana: University of Notre Dame Press).

[180] Fukuyama F (2002) *Our posthuman future: consequences of the biotechnology revolution* (London: Profile Books).

[181] Habermas J (2003) *The future of human nature* (Cambridge: Polity).

[182] Ibid.

A related idea is that attempts to alter human nature are wrong since they engender an inappropriate desire for human mastery and a failure to appreciate the 'gifted' character of human life and experience. Philosopher Michael Sandel has noted that arguments about enhancement are *"always, at least in part, arguments about telos, or point..."* and argues that these technologies are problematic since they represent an inappropriate human ambition to control and alter the natural world:

> *"The deeper danger [with enhancement and genetic engineering] is that they represent a kind of hyper-agency, a Promethean aspiration to remake nature, including human nature, to serve our purposes and satisfy our desires. The problem is not the drift to mechanism but the drive to mastery. And what the drive to mastery misses, and may even destroy, is an appreciation of the gifted character of human powers and achievements."*[183]

These ideas have particular implications for specific bioethics issues. Developments in sports science and other fields of physical enhancement, for example, are areas in which ideas about human nature and naturalness may be important. It might be this concern that underlies anxieties about the use of performance-enhancing drugs, the genetic modification of athletes, or the use of highly developed prosthetic limbs.

Social scientist Jason Mazanov explains how issues of naturalness relate to one standard account of sport:

> *"On this traditional account, sport is thought to be the testing of natural abilities, that is, unaided by substances or methods external to the athlete. Performance enhancing drugs tamper with the body and interfere with nature. Thus, drugs should be banned because they introduce artificial, foreign substances into the body to help produce training or performance enhancements that could not be achieved otherwise."*[184]

This characterisation makes the idea of 'natural abilities' essential to the value and nature or sport. Sport on this picture is an exercise serving to display the limits of natural human physical capacities and enhancing technologies undermine this element of sporting achievement. Michael Sandel says that we feel unease at the prospect of genetic modification to support sporting achievement since:

> *"... Genetically altered athletes... corrupt athletic competition as a human activity that honors the cultivation and display of natural talents."*[185]

Natural talents are gifts and enhancing technology *"distorts and overrides natural gifts".*[186] A similar argument is defended in a report by the President's Council on Bioethics, *Beyond therapy*, in which enhancing technologies and the value of human achievement are discussed. This report links the problem to the value of agency and dignity, and suggests that enhancing technologies raise problems of unnaturalness

[183] Sandel M (2009) *The case against perfection* (Cambridge, MA: Harvard University Press).
[184] Mazanov J (2011) *Towards a social science of drugs in sport* (Abingdon, Oxfordshire: Routledge).
[185] Sandel M (2009) *The case against perfection* (Cambridge, MA: Harvard University Press).
[186] Ibid.

in *"violating or deforming the nature of human agency and the dignity of the naturally human way of activity."*[187] In the context of sport, this is described in the following way:

> *"When and if we use our mastery of biology and biotechnology to alter our native endowments – whether to make the best even better or the below average more equal – we paradoxically make improvements to our performance less intelligible, in the sense of being less connected to our own self-conscious activity and exertion."*[188]

If some novel technologies are unnatural and wrong for this kind of reason, it must be that human beings have a nature that is real and which it would be wrong to modify or alter in certain ways. However, this topic is itself the subject of extensive debate and there is disagreement over whether anything that could be properly described as human nature really exists.

It might be said that the dominant trend across the relevant disciplines over recent years has moved away from the idea that there is any such thing as human nature. Arguments to support the idea that there is no human nature can be found in different fields of thought, including in continental philosophy. Existentialist philosophers writing in the early 19th Century, for example, favoured a stripped-down view of the self, which was elucidated by Jean Paul Sartre:

> *"There is no human nature… Man first of all exists, encounters himself, surges up in the world and defines himself afterwards. If man as the Existentialist sees him is not definable it is because to begin with he is nothing. He will not be anything until later and then he will be he makes himself."*[189]

This view echoes other ideas within existentialist thought concerning freedom and the self. The expression "existence precedes essence" is sometimes used to articulate the idea that human beings create their own meaning and do not derive value from the kind, or nature, of being they manifest.[190]

This 'blank slate' view of the human self shares some features with ideas present in evolutionary biology and the philosophy of biology, which might be thought to undermine the idea that there is any such thing as human nature. Biologist Michael Ghiselin, for example, has said that *"[evolution] teaches us that human nature is a superstition."*[191]

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187 The President's Council on Bioethics (2003) *Beyond therapy: biotechnology and the pursuit of happiness*, available at: https://bioethicsarchive.georgetown.edu/pcbe/reports/beyondtherapy/index.html.

188 Ibid.

189 Sartre J (1988) Existentialism is a humanism, in *Existentialism from Dostoevsky to Sartre*, Kaufman W (Editor) (London: Penguin).

190 See: Stanford Encyclopedia of Philosophy (2004) *Existentialism*, available at: http://plato.stanford.edu/entries/existentialism/.

191 Ghiselin MT (1997) *Metaphysics and the origin of species* (Albany, New York: State University of New York press).

The precise implications for the existence and character of human nature of work in evolutionary biology and other parts of the natural sciences are not obvious, however, and there has been debate about what our current scientific picture entails on this subject. Evolutionary psychologist Steven Pinker is a well-known advocate of the idea that there may be general, biological traits in human beings that can be important in explaining human behaviour. His view is that evolutionary psychology supports, rather than undermines, the idea that human nature exists.[192]

Pinker has argued that opposition to the notion of human nature may be related to resistance to the idea that our lives are partly determined by our genes. This is partly to do with the potential differences between groups of people, as much as common human features. Some worry that looking for genetic bases for certain kinds of behavioural features may identify differences amongst distinct groups which may be seen to legitimise certain inequalities. Such ideas may also be seen to suggest a kind of fatalism about what we would normally view as moral failings, and that we would otherwise strongly discourage. Dispositions to ethically abhorrent actions like rape, which some have argued is based in the nature of male sexuality, might be an example of this.[193] Pinker says that *"... to acknowledge human nature, many think, is to endorse racism, sexism, war, greed, genocide, nihilism, reactionary politics, and neglect of children and the disadvantaged."* However, on Pinker's view, this is a mistake; he argues that, whatever the details of the picture painted by modern evolutionary theory, *"a universal, complex human nature will be part of it."*[194]

It has also been proposed that an account of human nature drawing analogies with work in the sciences might support a view which construed the human species as having an intrinsic physical 'essence', or nature, in the same way that chemical elements are known to. A version of this view is defended by philosopher Michael Devitt who has recently argued in favour of 'biological essentialism' which takes essences to be, in part, *"underlying intrinsic, mostly genetic properties."*[195]

Philosopher Tim Lewens has argued, however, that this view has now largely been rejected because species membership is more commonly regarded as being *"united not by virtue of possessing similar intrinsic properties, but instead by virtue of the relations [members] stand in to each other."*[196] This makes the idea of an underlying set of essential biological or genetic properties less plausible as a candidate for human nature. For this reason, he argues that:

> *"To the extent that there is any philosophical consensus regarding biological species, it is that biological species fall into an entirely different category of thing, metaphysically speaking, to chemical elements."*[197]

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192 Pinker S (2003) *The blank state: the modern denial of human nature* (London: Penguin Books).

193 As defended in: Thornhill R and Palmer CT (2001) *A natural history of rape: biological bases of sexual coercion* (Cambridge, Massachusetts: MIT Press).

194 Pinker S (2003) *The blank state: the modern denial of human nature* (London: Penguin Books).

195 Devitt M (2008) Resurrecting biological essentialism *Philosophy of Science* **75(3)**: 344-82.

196 Lewens T (2015) Human nature: the very idea, in *The biological foundations of bioethics*, Lewens T (Editor) (Oxford: Oxford University Press).

197 Ibid.

A further question concerns the moral significance of human nature and its relevance to bioethics. Even if there were a distinctive and unique human nature this would not, on its own, show that human beings should not use science, technology, and medicine to modify it. It would need also to be true that human nature has value of some kind, and that changing it would be wrong.

Philosopher David Hull has argued, for example, that the only characteristics that could be truly said to be possessed by all human beings are so generic that they could not form the basis of a morally important, shared human nature. Hull has claimed that human nature may exist, but it is of no real ethical significance and is not something we should be concerned to preserve. Prohibiting 'unnatural' enhancing technologies or other parts of new science on the basis that it undermines human nature would not be justified on such a view.[198]

Another point that has been made on this topic is that, even if it were true that there is a distinctive feature, or set of features, which constitutes human nature, this would not necessarily be a morally valuable aspect of humanity. As Bernard Williams has pointed out *"killing things for fun"*[199] is something that only humans do, but that does not make it a good or worthy goal for the species. Robert Nozick has made a similar point, arguing that having a special, distinguishing characteristic says nothing about the value of this feature:

> *"If some conclusion about the flourishing appropriate to man follows from his having a certain property, surely it is in virtue of the nature of that property, not because other beings do not possess it… The problem with the Aristotelean framework is that a special property need not be an especially valuable one. Yet surely what should flourish are your valuable characteristics…"*[200]

There are, nevertheless, alternative conceptions of the value of what is natural for people that focus less directly on the identification of universal, distinctive and valuable human features. Habermas, for example, sees the ethical issues raised by human genetic modification as relating to human nature in virtue of its implications for human freedom, identity, and interpersonal relationships.

Genetically modifying one's children, Habermas argues, would undermine their freedom and self-identity in unacceptable ways. Altering natural human reproductive processes in this fashion involves *"exercising a kind of control... that intervenes in the somatic bases of another person's spontaneous relation-to-self and ethical*

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198 Hull DL (1986) On human nature *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association* **2**: 3-13.

199 Williams B (1972) *Morality: an introduction to ethics* (Cambridge: Cambridge University Press).

200 Nozick R (1981) *Philosophical explanations* (Cambridge, Massachusetts: Harvard University Press). The same point is made by Thomas Hurka on the role that *distinctiveness* of human nature, or human essence, would play, even if this feature were morally valuable, since it seems the worth of this feature should not depend upon whether other species had the same, or similar, features: *"… At present, humans are the only beings with full rationality. But what if dolphins develop rationality? Will this development make its exercise no longer good in humans? What if we discover beings on another planet that have always been rational? Will our rationality have never been good?"* See: Hurka T (1993) *Perfectionism* (New York: Oxford University Press).(Hurka, T (1993) *Perfectionism*)

freedom." This influence is morally problematic since it involves making irreversible decisions about the natural traits of another person and thereby undermines that person's capacity to assume responsibility for her life and to *"take possession of what she is*".[201] According to this view, the unpredictable, contingent aspect of natural human reproduction *"... proves to be – in the very moment we can master it – a necessary presupposition of being-able-be-oneself."*[202]

This has negative consequences for the genetically modified person, who is destined to remain *"blindly dependent on the nonrevisable decision of another person"*[203] and also fundamentally changes the nature of the relationship between parent and child.

> *"A previously unheard-of interpersonal relationship arises when a person makes an irreversible decision about the natural traits of another person."*[204]

These techniques alter the *"fundamentally egalitarian nature of our interpersonal relationships"* and so enable parents to exceed the proper domain within which they wield power over the lives of their children. They are wrong because they *"obliterat[e] the boundary between persons and things".*[205] According to this view, the value of what is natural for humans is connected to a range of other interrelated and complex involving freedom, identity, control, and fatalism.

Section summary

One way of thinking about the importance of naturalness concerns the idea that there are natural ways of being, or a natural purpose, for people, animals, and the environment.

This idea is linked with Aristotelian notions of flourishing and the fulfilment of natural functions. Some argue that living outside of natural environments can make it harder for animals to flourish, or that interventions which interfere with boundaries between natural species are wrong. For human beings, these notions are especially prominent in debates about human enhancement where a key issue concerns the existence and status of human nature. Key points relate to whether human nature may have a biological basis, whether there are any traits common enough amongst all people to be thought of as human nature, and whether distinctive human traits are necessarily valuable. Also important is how these topics may relate to other issues, such as freedom, identity and interpersonal relationships.

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201 This kind of influence he thinks is different to that exerted by "the contingencies of our socialization" with respect to which a person may yet "work out a revisionary self-understanding". See: Habermas J (2003) *The future of human nature* (Cambridge: Polity).

202 Ibid.

203 Ibid.

204 Ibid.

205 This position is suggestive of Kantian moral theory which entails that persons must be treated as ends and not means, and is reflected in Habermas' comments that genetic modification and trait selection "imply the license to control the physical basis which "we are by nature". What, for Kant, still belonged to the "kingdom of necessity" had, in the perspective of evolutionary theory, changed to become a "kingdom of contingency". Genetic engineering is now shifting the line between this natural basis we cannot dispose over and the "kingdom of ends".

4.5 Disgust and monstrosity

In some cases, it can seem that there is a certain kind of instinctive response some people have to novel technologies which might be linked to concerns about naturalness. Some technologies in particular appear to elicit responses of disgust, repugnance, revulsion, and other negative emotions which may be connected to objections to 'unnatural' science.

As suggested in section 4.4, it is not necessarily worries about the *effects* of technologies which underlie this objection to unnaturalness; nor need these responses be connected to any ideological view about human nature or natural function. Instead, objections to unnaturalness of this kind may be explained by a visceral response to what are perceived to be repugnant, weird, or disturbing products of science and technology. People may take these responses to be significant and feed into their perceptions of the ethical acceptability of the technology concerned.

For example, the idea of eating *in vitro* meat, having animal organs transplanted into one's body, or the idea of creating a person through the use of cloning techniques, may all trigger these type of responses in some people, and it may be this reaction that underlies objections to what is unnatural in those cases.

The Nuffield Council's 2012 report *Emerging biotechnologies: technology, choice and the public good* addressed ideas about the role of disgust and other sentiments in moral reasoning, noting that these can play an important role in social cohesion and form effective constraints on behaviour:

> *"Notions of natural order, harmony and ends are deeply engrained in almost all cultures, and bind groups and societies together. The term the 'wisdom of repugnance' has been coined to evoke and enjoin a shared sense of distaste for certain biotechnological practices that appear 'contrary to nature' in this sense... Where such sentiments are widely shared they can form a powerful basis for moral restraint and, indeed, for positive legislation..."*[206]

Much of the media discourse around cloned meat, synthetic food or genetically modified organisms appears to be influenced by these types of idea. Debate about genetically modified food in the UK is frequently discussed by reference to 'frankenfoods' and 'Google burgers'[207] and other "*genetically modified monsters*" which are described as '*revolting'*, '*inedible'* and '*unpalatable*'.

> *"…The new frankenburger* ***turns my stomach****."* (The Daily Mail, 2012)

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[206] Nuffield Council on Bioethics (2012) *Emerging biotechnologies: technology, choice and the public good*, available at: http://nuffieldbioethics.org/wp-content/uploads/2014/07/Emerging_biotechnologies_full_report_web_0.pdf, at paragraph 4.12.

[207] So named in virtue of the fact that research underlying their development has been funded by Google co-founder Sergey Brin. See: The Guardian (5 August 2013) *Google's Sergey Brin bankrolled world's first synthetic beef hamburger*, available at: http://www.theguardian.com/science/2013/aug/05/google-sergey-brin-synthetic-beef-hamburger.

> *"Personally, I find something **unnatural** and **disturbing** about cheese that never moulds or milk that never sours."* (The Telegraph, 2011)

Language evoking disgust also features prominently in public debates relating to cosmetic enhancement and appearance, particularly in media coverage. Many uses of the term *unnatural* in these contexts involve ideas connected to oddity and fear, and simultaneously use terms such as *freakish*, *eerie*, or *scary* when people are thought to have made excessive use of, or undergone poorly administered, procedures.

> "... ***Eerily** smooth-skinned…"* (The Daily Mail, 2013)

> *"… The increasing number of images of celebrities with plastic faces and **scarily unnatural** plumped-up features…"* (The Sun, 2015)

> *"I also knew a few people who'd overdone it and started to look **weird** – stretched and shiny".* (The Daily Mail, 2013)

These ideas also seem to be present within discussion of assisted fertility techniques.

> *"It was very real for us; we were scared to death that we were going to raise a **freak**, because everyone was saying that what we were doing was **unnatural**."* (The Guardian, 2012)

> *"Most people will surely regard [male birth] as just plain **weird**, even **revolting**. This is not prejudice. Such a reaction speaks from an innate feeling about men and women, their roles, family life, about what is '**natural**'."* (The Daily Mail, 2012)

> *"On face value, it's a story to make anyone **recoil**… using a donor egg fertilized by Kyle's sperm she became the first woman to be a surrogate for her own son."* (The Daily Mail, 2015)

The review of research on public perspectives on naturalness included evidence on attitudes towards xenotransplantation, and found that disgust and the idea of a transplanted animals organs 'feeling wrong' were prominent in this area, particularly:

> *"The whole pig nature just **feels like** a big 'no'."*[208]

> *"I used to buy pig liver pre-packed at the supermarket. To have it inside me – well, it feels a bit **disgusting**."*[209]

> *"The mere knowledge that I'll go around with a pig's kidney is **horrifying**."*[210]

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[208] Sanner MA (2001) People' s feelings and ideas about receiving transplants of different origins – questions of life and death, identity, and nature' s border *Clinical Transplantation* **15(1)**: 19-27.

[209] Ibid.

[210] Ibid.

Notions of ghoulish unnaturalness run through these examples and are often associated with criticism of the techniques, products, or people concerned. Implications of these kinds, invoking horror, monstrosity, and science fiction featured in public debate on food issues and cosmetic procedures. Reference to Frankenstein and other examples of science fiction were recurring themes:

> *"The idea of eating meat from the offspring of a cloned animal conjures up images of a* ***science fiction*** *world where the food chain is manipulated by geneticists and where the natural rhythms of life are ignored in the name of profit."* (The Daily Mail, 2011)

> *"... The products of a "****Frankenstein*** *food laboratory".* (The Guardian, 2014)

> *"Online comments about [a celebrity reported have undergone a cosmetic procedure] varied from the affectionate 'we love you whatever you look like', to the downright cruel 'she looks like a* ***Doctor Who creature****'…"* (The Daily Mail, 2012)

> *"Just as* ***Frankenstein's*** *creation was produced by sticking together bits from many different bodies, it seems that there is no violation of the norms of nature or human culture at which scientists and their bioethical helpers will balk."* (Human Genetics Alert, 2012, *Human Genetic Engineering on the Doorstep: The threat of 'mitochondrial replacement' techniques*)

Public debates on cosmetic surgery and other cosmetic procedures commonly make use of the term *natural* to praise unenhanced women who are depicted as attractive without the aid of cosmetic enhancement. Many examples of the use of the word *natural* involve description of 'natural beauties' who (it is reported) have not been enhanced, either by surgery, other cosmetic procedures, or make-up.

> *"****Natural*** *beauty trumps artificial beauty in the hierarchy, but it is a fact that you cannot look the same for ever without having something done."* (The Daily Mail, 2013)

Though some of the language used in these examples may appear extreme, or even reactionary, there are some clear, common themes running through these cases. Each of these examples seem to be linked to a particular kind of negative response, connected to disgust, revulsion, or repugnance at the 'unnatural' products of novel science, technology, and medicine.

Alongside language invoking ideas about disgust, there is often also a link with horror and the grotesque that is particularly pronounced in media coverage of novel science. As Philip Ball notes *"… however lazy and unconsidered such journalistic references to Frankenstein are, they convey something. We think we know what they're getting at. And it is not something good"*.[211]

These appeals to Frankenstein and use of the stem 'Franken' carry with them associations which invoke fear, violence, and loss of control. Ball explores these

[211] Ball P (2012) *Unnatural: the heretical idea of making people* (London: Vintage).

ideas and stresses the links between debates on bioethics topics and notions borrowed from science fiction narratives.

> *"An allusion to the 'old' myths – to the alchemical homunculus, Faust, Frankenstein,* Brave New World *– is almost de rigueur in public discussions of assisted conception, 'designer babies', genetic modification, embryo research and cloning."*[212]

Theologist Henk can den Belt argues that, in some areas, any products of science, technology and medicine which are perceived to be unnatural are considered monstrous:

> *"In science, technology and medicine studies, entities that challenge the settled boundaries of nature and society are often designated as 'monsters'."*[213]

Many of the science fiction concepts appropriated for discussion of topics in science, technology, and medicine are taken from narratives, such as those mentioned by Ball, which embed morality within tales about the disastrous consequences of being too technologically adventurous. These stories are implicit warnings about the dangers of experimental science. As bioethicist Sarah Chan has argued when these parallels are drawn, a message about ethics is often being conveyed:

> *"Creatures and concepts from science fiction populate bioethical debate, albeit sometimes as a form of metaphorical shorthand for an underlying argument. One such example is that of Frankenstein's monster, often invoked to illustrate the dangers of "playing God", the moral sin of humankind daring to reach beyond our natural limitations."*[214]

In alluding to these cautionary tales with language like 'Frankenfoods' and 'Frankensteination', positions on the acceptability of these technologies are covertly adopted, conveyed, and possibly absorbed by audiences. Utilising these loaded ideas from within fiction means that the requirement to provide any explicit support or argument for the idea that the technology in question – *in vitro* meat, genetically modified plants or animals, or meat from cloned animals – is ethically problematic, or unsafe, is veiled, with the result that critical perspectives are comminucated undefended.

Some may take these observations to debunk the idea that naturalness matters at all. If the suggestion is that those objecting to 'unnatural' technologies simply find the idea of having a pig heart transplanted into their body grotesque or horrific, or feel that eating synthetic meat would be repulsive, then this might appear to be easily separable from ideas about ethics and acceptability.

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212 Ibid.

213 Belt H (2009) Playing god in Frankenstein's footsteps: synthetic biology and the meaning of life *NanoEthics* **3(3)**: 257-68.

214 Chan S (2009) More than cautionary tales: the role of fiction in bioethics *Journal of Medical Ethics* **35(7)**: 398.

However, there is debate about the role and significance of disgust responses and some have argued that these reactions can serve as reliable guides as to what is morally problematic.

The most prominent defender of the idea that disgust is a morally significant response is former head of the US President's Council on Bioethics, Leon Kass. His influential paper *'The wisdom of repugnance: why we should ban the cloning of humans'* argues that repugnance serves as a guide to what is morally 'foul', and that reactive responses involving disgust and revulsion should be taken seriously as indicators of moral wrongness:

> *"To pollution and perversion, the fitting response can only be horror and revulsion; and conversely, generalized horror and revulsion are prima facie evidence of foulness and violation. The burden of moral argument must fall entirely on those who want to declare the widespread repugnances of humankind to be mere timidity or superstition."*[215]

Kass' argument concerns cloning, but the point applies across the ethics of novel science, technology, and medicine. His claim is that we should pay attention to these repugnance responses and that, when they are common, the onus is on those who doubt the significance of such reactions to show how these reactions might be explained without appeal to 'pollution and perversion' – or without appeal to the wrongness of the technology that produces them. A similar idea to Kass' is expressed by sociologist John Evans who states that *"visceral reactions are not irrational tendencies to be supressed, but unarticulated wisdom from which we can learn*."[216]

A related position is defended by the philosopher Mary Midgley who argues that we ought not dismiss what she terms 'emotional responses' as *"mere feeling"*. Midgley argues that it is a mistake to construe opposing sides of the debate as disputes over the proper authority of either reason or feeling, since reason and feeling are involved in both sides of the argument.

> *"I want to suggest that it is usually a bad idea to see debates in this way as flat conflicts between reason and feeling because usually both thought and feeling are engaged on both sides... the sense of disgust and outrage is in itself no sign of irrationality. Feeling is an essential part of our moral life."*[217]

Support for the idea that sentiments which express disgust are important may also come from other disciplines. There are a number of examples of scenarios to which it is common to react with disgust or repugnance, where people apparently simultaneously perceive, or intuit, moral wrongness. For example, it has been argued that common moral responses to hypothetical actions with no clearly

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215 Kass L (2 June 1997) *The wisdom of repugnance*, available at: http://web.stanford.edu/~mvr2j/sfsu09/extra/Kass2.pdf.

216 Evans JH (2002) *Playing god? Human genetic engineering and the rationalization of public bioethical debate* (Chicago, Illinois: University of Chicago Press).

217 Midgley M (2000) Biotechnology and monstrosity: why we should pay attention to the "yuk factor" *The Hastings Center Report* **30(5)**: 7-15.

identifiable harmful outcomes – such as eating one's (already) dead dog – can be explained by appeal to the idea that moral judgments are strongly influenced by disgust response.[218]

This line of argument relates to a body of work exploring the explanatory role that such judgments play. This work purports to show that disgust reactions are often a better guide to actual moral responses than judgments about the harmful outcomes of acts. Paul Rozin and Joanathan Haidt have conducted a series of studies defending these ideas.[219]

There is a substantial body of work supporting these ideas, which suggests that disgust reactions are important in guiding the judgments people make about ethics. So strong is the effect that some have argued that such judgments could be marshalled by governments in pursuit of public health goals and other social goods. It might be that policy-makers should regard such responses as a *"potent tool that can and should be harnessed to help shape a society and used to bring about targeted social change."*[220]

These accounts of the prominent role of disgust reactions in explaining or predicting moral judgments are appealed to within what are sometimes described as *descriptive* accounts of ethics. These accounts describe how people actually respond to, and reason in, moral situations, and therefore form the bases of useful explanations of how people tend to think about ethical issues, including issues relating to genetic modification, cloning, and other bioethics topics.

However, these views do not necessarily tell us anything about whether our disgust reactions are actually *informative* on matters of ethics. They suggest that disgust tends to play this role in how people respond to ethics scenarios, but do not necessarily say anything about whether our disgust reactions are generated by apprehension of what is really wrong, and are therefore neutral on whether or not disgust *should* play this role in moral judgment. Daniel Kelly, philosopher and author of *Yuck: the role and moral significance of disgust* poses this question as follows:

> *"Given the picture emerging from these empirical facts about the character and influence of disgust, one can ask, on the other hand, how well or poorly that picture matches the ideal. Is disgust the type of psychological propensity that ought to be involved in morality in some way or another?"*[221]

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218 Haidt J, Koller SH and Dias MG (1993) Affect, culture, and morality, or is it wrong to eat your dog? *Journal of Personality and Social Psychology* **65(4)**: 613-28.

219 Schnall S, Haidt J, Clore GL and Jordan AH (2008) Disgust as embodied moral judgment *Personality & Social Psychology Bulletin* **34(8)**: 1096-109; Haidt J (2001) The emotional dog and its rational tail: a social intuitionist approach to moral judgment *Psychological Review* **108(4)**: 814-34; Haidt J, Koller SH and Dias MG (1993) Affect, culture, and morality, or is it wrong to eat your dog? *Journal of Personality and Social Psychology* **65(4)**: 613-28.

220 Kelly D and Morar N (2014) Against the yuck factor: on the ideal role of disgust in society *Utilitas* **26(2)**: 153-77.

221 Ibid.

Even if this question is answered in the affirmative, there is a further issue concerning how, exactly, disgust reactions should be incorporated into debates about the ethics of science, technology, and medicine.

> *"If so, what role should it play, which aspects of society should it be used to help regulate, and how would it ideally be reflected in and employed by legal and political institutions?"*[222]

A further issue relates to how succesful this feature of human response might really be as a tool to sort science, technology, and medicine into 'acceptable' and 'unacceptable' categories. One issue relates to agreement; what is disgusting to one person may not offend the next. We might also expect to see differences in what is taken to be disgusting across different social groups and cultures. This may undermine the idea that we are able, practically, to rely on disgust responses as a guide to what is right and wrong. As Daniel Kelly notes:

> *"Everyone is disgusted by something or other, but common sense and casual observation suggest that different things will disgust people with different sensibilities and different cultural backgrounds. One group's delicacy is another group's revulsion. Each of us has his or her own personalized and idiosyncratic objects of disgust as well."*[223]

This idea is reflected in the discussion within the Nuffield Council's *Emerging biotechnologies* report, which notes that when society concurs on what technologies have this feature, this can be utilised, but also that *"where there are moral disagreements, moral arguments can quickly reach an impasse (since my sentiment towards a given action does not logically contradict your different sentiment)."*[224]

Section summary

This section has explored the idea that some appeals to what is natural and unnatural may be rooted in certain kinds of human reaction, which may involve disgust, horror, or other negative responses. These reactions are sometimes linked to references from science fiction.

Important ideas in this context concern the role that disgust responses play in moral reasoning and whether they should be construed as telling us something important about the ethics of novel science, technology and medicine which prompt them. Defenders of this view think that widespread disgust reactions to technologies perceived to be unnatural indicate that these technologies are morally problematic and it has been argued that disgust reactions are closely connected, psychologically, to moral judgment. Some, however, deny that these responses indicate anything about the ethical status of science, technology and medicine, sometimes pointing to variation in disgust reactions between indviduals and cultures.

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[222] Ibid.

[223] Kelly D (2011) *Yuck! The nature and moral significance of disgust* (Cambridge, Massachusetts: MIT Press).

[224] Nuffield Council on Bioethics (2012) *Emerging biotechnologies: technology, choice and the public good*, available at: http://nuffieldbioethics.org/wp-content/uploads/2014/07/Emerging_biotechnologies_full_report_web_0.pdf.

4.6 God and religious belief

Some of the examples from our review of public debate and of literature on public perspectives make appeal to religious concepts, including the will of God, divine order, and miracles. Religious belief is another source of concern about naturalness which, for some, may involve the idea that certain technologies serve to undermine a divine natural order, distort God's creation, or otherwise contravene the will of God.[225]

These types of concern might underlie objections to a range of science, technology and medicine, including assisted reproduction, genetic modification of food, animals and people, cloning, cosmetic enhancement, and death and dying.

For example, some may feel that the constraints on the age at which a woman usually can give birth are a part of the natural world God created and as such are a part of what God intended for human beings. Enabling women to have children at an age older than would normally be possible alters this feature of the natural world, some believe, and disregards God's wishes for how the world *should* be. Similarly, it might be thought that the genetic structures of plants, animals and people were determined by God in the act of creation, and that altering these features of the natural world subverts or distorts God's creation.

Engaging in these 'unnatural' activities therefore might be wrong because they are not what God wants or intends us to do. There are overlaps between these ideas and ones relating to natural purpose and function, since one way of answering the question of why human nature and natural boundaries are important is that such categories have been created by God.

A small number of the examples identified in the review of media, Parliamentary, civil society and science sources, and the review of research on public perspectives, made explicit reference to religion and God. Discussion sometimes appealed directly to the word of God, or God's will or choice, in ways that suggest that religious belief was a key part of the concern being expressed.

Topics in which this idea seemed to be present include reproduction and parenting:

> *"Where **nature** itself spontaneously aborts a good many embryos in these very early stages of life, it is hard to feel that to do so deliberately for good reason is contrary to **God's own mind**, so far as that is revealed in his created order."* (Parliamentary debate on Human Reproductive Cloning Bill, 2001]
>
> *"I do not rule out the possibility of putting a locus for a second female with the child of a couple – I am undecided on that and it should be looked at – but to rule out the male responsibility seems*

[225] This section explores predominantly those ideas associated with a Western/Judaeo-Christian conception of God and religion, and its implications for views about the notion of naturalness within the ethics of science, technology and medicine. A much richer discussion of these ideas is possible and would involve appeal to religious belief in other parts of the world, including Islaam, Hinduism, Budhism and others, as well as deeper exploration of rival ideas about the particular implications of religious views in the West too.

> *to go in the face of **nature, religion** and good sensible politics on the part of a Government who are trying to stop overfilling the jails of this country."* (Parliamentary debate on Human Fertilisation and Embryology Bill, 2007)
>
> *"I make no apology for standing up for what I believe to be the **natural** order of things... that it is a **natural** thing for a family to consist of a man and a woman who have children, and who give those children a **natural** and a proper home... but I stand by my **faith** and the **word of God** that man was created in the image of God and that woman was created from the rib of Adam to be his helpmeet and companion."* (Parliamentary debate on Clause 14 – Conditions of licences for treatment, 2008)
>
> *"I don't think that you can just discard an embryo that has been fertilised, or change that in any way because I just don't believe that that is **the way God intended it to be**… I think that's an ethical thing, and I think that's **God's choice** and not mine, or the doctor's or anybody else's."*[226]

Death and the extension of human life:

> *"We are not allowed to die **naturally**. The doctors and medicines keep us alive beyond the need for us to be alive… It has undermined the security that some have felt in the sense that **God** is in control of life and death, and therefore that our responsibility simply has to be to assist him in what is the best that we can arrange."* (Parliamentary debate on Assisted Dying for the Terminally Ill Bill, 2006)

Genetic modification:

> *"We can't be assisting **nature** if we want to breed a cat that doesn't catch birds or mice. The whole essence of a cat being put on the Earth by **God** is to catch birds and mice. That's what they do. So we're not – however many millions of years we breed cats they will always catch birds and mice. What this can do is, it can take an animal and it can alter its characteristics, and that's what I think you should be thinking about, is do we want a dog that doesn't bark, do we want a cat that doesn't catch mice."*[227]

Cosmetic enhancement:

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[226] Kalfoglou AL, Doksum T, Bernhardt B et al. (2005) Opinions about new reproductive genetic technologies: hopes and fears for our genetic future *Fertility and Sterility* 83(6)

[227] Macnaghten P (2004) Animals in their nature a case study on public attitudes to animals, genetic modification and 'nature' *Sociology* 38(3)

> *"I believe in pureness of the body… everything **natural**. I had dreads, which is natural, no chemicals, no nothing… **whatever God says**, that's what it is, that's where my heart is at."*[228]

It was more common, within the material reviewed, for religious concepts to feature in debates in ways that were ambiguous as to whether theistic belief was really at the root of the concerns expressed. Use of the expression 'playing God' was common (for more examples see section 4.3) but arguably not made exclusively by those with religious belief. People also used expressions like the 'image of God' and 'miracles of nature' and appealed to the idea of natural boundaries and human nature:

> *"Getting pregnant is a **miracle of nature.** It's not enough for an egg to become fertilised and develop into an embryo. It also has to implant into the womb about two weeks later and stay there for months."* (The Sun, 2014)

> *"The creation of hybrid embryos undermines our dignity and is fundamentally disrespectful of the boundaries of **nature.** It would tarnish the "**image of God**" present in all of us, would breach the biblical prohibition of the mixing of kinds, would confuse lineage, would fundamentally affect all human relationships…"*
> (Parliamentary debate on Human Fertilisation and Embryology Bill, 2008)

> *"... From a religious perspective, the whole scientific endeavour should been seen not as a rival to religion but as a way of exploring the wonder and **miracle of nature**."* (House of Lords debate on stem cell research, 2007)

Nevertheless, the conception of nature as the creation of God, and the implications this has for the relationship between human beings and nature, forms part of the belief system of many religious people. It is likely, therefore, to be a significant and important consideration for many when thinking about the associations between naturalness and ethics, and when appraising the acceptability of novel science, technology, and medicine.

The concern that unnatural interventions might be unethical insofar as they contravene the will of God is expressed by philosopher John Stuart Mill in the following passage:

> *"The consciousness that whatever man does to improve his condition is in so much a censure and a thwarting of the spontaneous order of Nature, has in all ages caused new and unprecedented attempts at improvement to be generally at first under a shade of religious suspicion; as being in any case uncomplimentary, and very probably offensive to the powerful beings (or, when polytheism gave place to monotheism, to the all-*

[228] Rubin LR, Chavez J, Alderman A and Pusic AL (2013) 'Use what God has given me': difference and disparity in breast reconstruction *Psychology & Health* 28(10): 1099-120

powerful Being) supposed to govern the various phenomena of the universe, and of whose will the course of nature was conceived to be the expression."[229]

It is the '*thwarting'* of the '*course of nature'* – on this view, a manifestation of God's will – which may be seen as causing offence to God. Unnatural technologies may obstruct God's intentions for the world and raise ethical issues for that reason.

Related concerns involve ideas about what nature exists for, from a religious point of view. The notion of respect for nature, as created by God for God's own ends, was acknowledged in the Council's 1999 report on genetically modified crops:

"... from a Judaeo-Christian perspective, it is an important truth that God created nature for His own purposes, not merely for our uses, and that these purposes are important, indeed that it is mandatory for us to respect nature as part of that creation."[230]

Another way of articulating what is wrong with unnatural interventions on a religious picture relates to the idea of *divine providence*. Tony Coady explains that, for those with religious belief, the notion of 'playing God' is problematic since it conveys a message about human beings presumptuously stepping into a sphere of activity properly occupied by God alone:

"… There are certain things that it is presumptuous for human beings to undertake because those matters are really in the care of God. The theological concept of "providence" is clearly at work here, at least in the background, and theistic religions have traditionally held that there is some sense in which God is in control of creation. Not only did God make the world but God conserves, shapes and cares for what goes on in that world."[231]

Implications for the ethics of novel science, technology, and medicine can be seen in some of the more specific articulation of these theological persepctives. For example, one idea represented in our own review, as well as within theological writing, is the idea, described in the book of Genesis, that man is made in the "image of God".[232] From a religious perspective, this forms part of an account of the sanctity of human life since "*the reason innocent human life is sacred is because human beings are created in the image of God."*[233]

This notion may ground constraints on particular kinds of human activity and is sometimes raised in the context of debate about the ethics of genetically modifying

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229 This point is widely observed in debates about bioethics but was originally made by John Stuart Mill in 1847. See: Mill JS (1885) *Three essays on religion: nature, the utility of religion and theism* (London: Longmans, Green).

230 Nuffield Council on Bioethics (1999) *Genetically modified crops: the ethical and social issues*, available at: http://nuffieldbioethics.org/wp-content/uploads/2014/07/GM-crops-full-report.pdf.

231 Coady T (2009) Playing god, in *Human enhancement*, Savulescu J, and Bostrom N (Editors) (Oxford: Oxford University Press).

232 Genesis 1:27.

233 Rae SB (1999) *Bioethics: a Christian approach in a pluralistic age* (Grand Rapids, Michigan: Wm. B. Eerdmans Publishing Company).

embryos or using embryos in research, and abortion. Theologians Scott B Rae and Paul M Cox argue that:

> *"… The combination of the doctrines of the image of God and the incarnation suggests that the image of God is resident from the earliest points of development, and thus embryos, foetuses and newborn children are all full persons with the corresponding rights to life."*[234]

Another idea about personhood present in Christian thought concerns communion with God. Theologian Gilbert Mailaender has argued that the Christian conception of people as *"free spirits… created ultimately for communion with God*" has implications for how we should use novel technologies for fertility and reproduction:

> *"… A moral vision shaped by this Christian understanding of the person will be prepared to say no to some exercises of human freedom. The never-ending project of human self-creation runs up against the limit that is God… We must be prepared to acknowledge that there may be suffering that we are free to end but ought not, that there are children who might be produced through technological means but ought not…"*[235]

Genetically modifying embryos, and thereby influencing fundamentally the trajectories of future human lives, might also be problematic since they interfere with distinctively human features, such as autonomy and freedom, which we should see as 'gifts from God'. Tony Coady explains that *"autonomy and freedom are... plausibly regarded by those religious people who value them (and some, of course, don't) as special gifts of God."*[236]

Views on the image of God, and the religious conceptions of personhood, agency, and autonomy are important to debates about naturalness since they bear on the question of what is fundamental to human beings, and to human nature. The idea that certain interventions in nature are wrong because they distort a divine natural order has connections with ideas about natural purpose, about what the world and the living beings inhabiting it, was created for. Arguments that appeal to divinely ordained roles or relationships with, and within, nature are therefore one way of justifying views about the importance of human nature or the value of natural roles or functions.

Relevant here is the set of theories grounded in what is known as 'natural law'. Versions of natural law, which takes the good to be grounded in and knowable through human nature, have been defended by philosophers including the enlightenment philosopher John Locke and, more recently, legal scholar and philosopher John Finnis.[237] The Catholic scholar St. Thomas Aquinas, however, is

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234 Ibid.

235 Meilaender G (2013) *Bioethics: a primer for Christmas* (Grand Rapids, Michigan: Wm B Eerdmans Publishing Co.).

236 Coady T (2009) Playing god, in *Human enhancement*, Savulescu J, and Bostrom N (Editors) (Oxford: Oxford University Press).

237 See both Locke's Second Treatise and Finnis J (1980) *Natural law and natural rights* (Oxford: Clarendon Press).

the first and best known advocate of natural law theory. Aquinas construes human nature as significant in virtue of its connection with God's eternal law and casts human good as intimately connected to our nature. His view holds that:

> *"… There is in man a bent towards things which accord with his nature considered more specifically, that is in terms of what he has in common with other animals; correspondingly those matters are said to be of natural law which nature teaches all animals, for instance the coupling of male and female, the bringing up of the young, and so forth."*[238]

Human nature is important according to this view since, as in the Aristotelian picture, it is closely connected to what is good for people. Our human nature determines our good in that *"it is sufficient for certain things to be good that we have the natures that we have; it is in virtue of our common human nature that the good for us ia what it is"*.[239] This would mean that enhancing technologies that threaten to alter human nature would be morally problematic.

These ideas about personhood, giftedness, human nature, and the human good relate to wider religious frameworks within which reproductive technologies, genetic modification and other techniques are appraised. Religious belief may influence different perspectives not simply on the rights and wrongs of certain activities, but on what, precisely, takes place when technology is used for certain purposes. This might concern, for example, the distinction between embryos and people, but also between reproduction and procreation,[240] being made rather than begotten,[241] and the difference between projects and gifts.[242] These distinctions are often made by those who believe them to be morally significant, and can underlie and explain concerns about the ethics of these technologies.

Need for God?

The above discussion outlines how religious belief can support one way of accounting for the existence and value of human nature. There is also a line of argument which suggests no concerns about naturalness make sense unless there is a divine author of nature, to whom we cause offence when we do unnatural things. Some might think that we need a religious framework in order to explain what it is that we find valuable about the natural and objectionable about the unnatural. A number of ideas discussed earlier in this paper would make sense in a religious framework: for example, the idea that nature is wise is easy to explain if it had an all-knowing, all-powerful creator; and there would be no need to explain what was wrong with playing God in the presence of an actual God.

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238 Aquinas T (1989) *Summa theologiae* (London: Eyre and Spottiswoode).

239 Stanford Encyclopedia of Philosophy (2011) *The natural law tradition in ethics*, available at: http://plato.stanford.edu/entries/natural-law-ethics/.

240 Meilaender G (2013) *Bioethics: a primer for Christmas* (Grand Rapids, Michigan: Wm B Eerdmans Publishing Co.).

241 Kass L (2 June 1997) *The wisdom of repugnance*, available at: http://web.stanford.edu/~mvr2j/sfsu09/extra/Kass2.pdf.

242 Meilaender notes that we should be free of the "idolatrous desire" to have children at any cost which would make children "our project rather than God's gift". See: Meilaender G (2013) *Bioethics: a primer for Christmas* (Grand Rapids, Michigan: Wm B Eerdmans Publishing Co.).

Appeal to *"Promethean fear", "holy dread", "reverence" and "piety"* [243] is sometimes made in debates about naturalness and bioethics and are notions which might be thought to make assumptions about a divine creator. Bernard Williams, within a discussion of the value of the natural environment has suggested that *"the religious sceptic, if he or she is moved by concerns of conservation, might be thought to be embarrassed by the supposed religious origin of these concerns"*.[244]

One area in particular where this objection has been levelled is in relation to philosopher Michael Sandel's influential arguments on the giftedness of human life. The idea of giftedness, which construes natural talents and children as gifts, may seem to require a gift-giver. These ideas may remain mysterious without the objective foundation that a belief in God would provide. Theologian Michael Banner expresses the point as follows:

> *"If we assert that there is an obligation to prefer "giftedness", "reverence" and "beholding" over "wilfulness", "dominion" and "molding" isn't that because we are making surreptitious assumptions about the origins of nature, human or otherwise?"* [245]

And since Sandel does not want to rely on theological claims, his argument may unfairly appropriate and depend upon on religious concepts. The notion of giftedness, Banner argues, is in fact part of a wider 'moral ecology' that cannot be separated from related ideas of respect, reverence, awe, worship and others, and as such cannot be taken up *"as if it were something off a supermarket shelf."*[246] Neverthless, Banner concludes that there are ways to account for the role that giftedness plays in these arguments without adopting a theological metaphysic. Giftedness may instead be understood as acquiring meaning and significance in virtue of the position it occupies within the wider, indispensible *"complex web of ways in which we speak, think and act, through which we understand and value the world"*.[247]

Other work exploring these ideas highlights the role that metaphor can play in debate on these topics. In a 2006 study examining attitudes towards social sex selection, bioethicist Jackie Scully and sociologists Tom Shakespeare and Sarah Banks explored the discourse around the use of prenatal sex selection and concluded that references to children as gifts were best understood as metaphorical.[248] The idea of children as gifts may function to convey a fundamental contrast with the idea of children as commodities, and a respect for personhood. The study also highlighted the significance of absence of control in the receipt of gifts, which can surprise the gift-receiver, illustrating the value of unpredictable outcomes in childbearing. Analysing language used in debates on reproduction and prenatal sex selection in this way suggests that these claims need not rely on theological truths to make

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243 Banner M (2009) *Christian ethics: a brief history* (Chichester: Wiley-Blackwell).

244 Williams B (1995) Must a concern for the environment be centred on human beings?, in *Making sense of humanity and other philosophical papers*, Williams B (Editor) (Cambridge: Cambridge University Press).

245 Banner M (2009) *Christian ethics: a brief history* (Chichester: Wiley-Blackwell).

246 Ibid.

247 Ibid.

248 Scully JL, Shakespeare T and Banks S (2006) Gift not commodity? Lay people deliberating social sex selection *Sociology of Health & Illness* **28(6)**: 749-67.

sense, and it is possible that an extension of this idea may explain and support other aspects of superficially religious terminology in similar ways.

Religious belief compatible with scientific endeavours

A separate issue concerns the commitments of religious belief and what would be required of human beings if nature were indeed the creation of God. Some have argued that religious belief, and its implications for the character of human nature, would not require us to refrain from engaging in novel scientific pursuits. For example, within the context of a debate about the use of recombinant DNA techniques, philosopher Gary Comstock argues that:

> *"If humans are made in the divine image, and if God desires that we exercise the spark of divinity within us, then it should be no surprise that inquisitiveness in science is part of our nature... It is unclear why the desire to investigate and manipulate the chemical bases of life should not be considered as much a manifestation of our God-like nature as the writing of poetry and the playing of sonatas should be."*[249]

The suggestion is that investigation into, and manipulation of, the natural world may form part of human beings' God-like – and God-given – nature, in which case such interventions should not be regarded as ethically wrong. The geneticist George Church has expressed a similar view. He comments: *"Engineering is one of the main things that humans do well... it's just what we do and it's natural".*[250]

A slightly stronger version of this position is that religious belief may even impose responsibilities to utilise novel science, technology, and medicine proactively to make positive changes to the world. This was an observation made in the Council's 1999 report on genetically modified crops, in which it was noted that a case for human intervention in nature, as well as certain kinds of 'abstinence', might be made on religious grounds, since: *"… biblical premises yield positive duties as well as restrictions on what we may do with the world."*[251]

Similar thoughts were expressed in responses submitted to the Council's public consultation on genetically modified crops by the Church of Scotland and the Office of the Chief Rabbi. The latter response emphasised the duty of human beings to reshape nature in appropriate ways: *"God's gift is a grant of sweeping authority to use the raw materials of nature wisely.."* and that there may be a responsibility for humanity to "*cultivate and reorder nature*".[252]

This view is also reflected in the work of the Christian Medical Fellowship:

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249 Comstock, G (2000) *Vexing Nature? On the Ethical case against Agricultural Biotechnology* (Boston: Kluwer Academic Publishers)

250 See: Church G (2006) *Constructive biology*, available at: http://edge.org/conversation/constructive-biology.

251 Nuffield Council on Bioethics (1999) *Genetically modified crops: the ethical and social issues*, available at: http://nuffieldbioethics.org/wp-content/uploads/2014/07/GM-crops-full-report.pdf.

252 Ibid.

> *"... the wise use of technology is to be supported and encouraged by Christians. Humans have always striven to tame or even transcend nature through technology, which has resulted in great improvements for humanity."*[253]

This idea may be best combined with a 'stewardship' model of human responsibility towards the world and its contents. According to this account, *"human beings should not seek to dominate nature but should instead stand in a relationship of care and concern for its continued flourishing."*[254] If humans are the stewards of nature, it is said, they would be permitted to intervene and alter aspects of it, but there would also be certain ways of treating the natural world which would be unethical.

Nevertheless, it has also been arguued that, even in a religious picture, it may be that the real ethical questions concerning the use of novel science, technology, and medicine relate to responsible innovation, sustainability and other notions, rather than naturalness as such. Theologian Ted Peters has said that biotechnology is an "*extremely complicated form of animal breeding. We're going to be changing the face of the planet no matter what. The question is do we want to do it responsibly or not?"*[255]

As with some of the other accounts we have described, the precise implications of a religious perspective of naturalness for the ethics of individual technologies will not always be clear. Even if we think that unnatural science is that which, in some way, fails to conform to God's plans or intentions, the things that we should construe as natural and unnatural may be hard to identify. Tony Coady has raised this point, arguing that "*... it is enough simply to stress the difficulty of knowing God's will and truth in so many complex settings and the deep tendency of the righteous to simplify..."*[256] which may mean that, even for those who take a religious view of the importance of the natural, further examination of the morally significant features of a given novel technology and its effects may need to be made in order to determine whether it is acceptable or not.

Section summary

Ideas about naturalness sometimes involve religious belief and views about the natural world as God's creation.

This section has looked at what certain religious concepts might imply regarding the status, or understanding, of certain technologies such as assisted conception techniques or the modification of human embryos. It also addresses the notion that ideas about naturalness, including the idea that children are 'gifts' may tacitly rely on

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253 Christian Medical Fellowship (2013) *Three-parent embryos for mitochondrial disorders*, available at: http://admin.cmf.org.uk/pdf/cmffiles/51_3_parent_embryos.pdf.

254 Nuffield Council on Bioethics (1996) *Animal-to-human transplants: the ethics of xenotransplantation*, available at: http://nuffieldbioethics.org/wp-content/uploads/xenotransplantation.pdf.

255 USA Today (19 August 2007) *Scientists struggle to define life*, available at: http://usatoday30.usatoday.com/tech/science/2007-08-19-life_N.htm.

256 Coady T (2009) Playing god, in *Human enhancement*, Savulescu J, and Bostrom N (Editors) (Oxford: Oxford University Press).

the idea of God and outlines alternative accounts of ‘giftedness’. It explores some ideas about different implications that religious belief may have for the moral status of scientific enterprise and how different models compatible with religious belief, such as notions of stewardship, may support the use of science technology and medicine.

5. Conclusions and recommendations

Ideas about naturalness can play a prominent role in public and political debates on the ethics of science, technology, and medicine.

We reviewed ideas about naturalness raised in public and political debates on science, technology, and medicine in the recent past and found many examples of discussions of these topics that associated what is natural with value. There are many words other than *natural, unnatural* and *nature* used to discuss science, technology, and medicine, which convey ideas about naturalness.

We found that people and organisations use the terms *nature, natural* and *unnatural* in a range of ways. Sometimes these terms are used in ways that connect the notion of naturalness with value, and convey ideas about what is good and bad, but they can also be used in more neutral ways, which make no appeal to value, and suggest nothing about what is good or bad.

There is an asymmetry between use of the terms *natural* and *unnatural*. The term *natural* is used much more commonly than the term *unnatural*, in a range of quite different contexts. *Natural* is usually used in a value-neutral way, for example in expressions such as ‘natural selection’ or ‘natural environment’. In contrast, the term *unnatural* is used much less frequently, but when it is used it is often to suggest that something is bad, wrong, or problematic.

It is not straightforward to define natural and unnatural things or processes: candidate definitions of the term *natural* often appear either too broad, and include as natural too many things that we are inclined to describe as unnatural; or are too narrow, construing things that appear quite natural as unnatural.

Equally, some are reluctant to classify natural things as good and unnatural things as bad. They point out that there are many natural things that appear to be bad (such as disease, earthquakes, and poisonous substances) as well as many unnatural things that we think of as good (such as medicine).

Some, therefore, believe that the terms *natural* and *unnatural* do not carry any significance or value and tend not to use them to comment on what is good and bad. Our work suggests that organisations which represent scientists, for example, rarely use these terms to convey values or beliefs. We call this a ‘neutral’ or ‘sceptical’ view of naturalness.

However, we also found many examples of the terms *natural*, *unnatural* and *nature* in the media, in Parliamentary debate, in the reports of civil society organisations, and in commercial advertising and labelling being used as ‘placeholders’ to convey a range of different values, beliefs, ideas, hopes and anxieties. Our work organised these into four broad accounts based on themes of the wisdom of nature, natural purpose, disgust and monstrosity. and God and religion.

This diverse set of ideas associated with naturalness, which vary between people and over time, may have implications for the usefulness of the terms *natural* and *unnatural* in public discussions about science, technology, and medicine. It is possible that the very different associations people make with what is natural mean

that people end up speaking at cross-purposes, or 'talking past' one another – using identical terms with different meanings – when using these words and thereby fail to fully understand one another. This means that effective communication on the ethics of science, technology, and medicine may be hindered, rather than helped, by appeals to naturalness.

Our work suggests that some people attach great importance to their views about whether something is natural or unnatural. It is important, therefore, that scientists and policy-makers probe and understand these values and beliefs so that they are genuinely able to take account of the views of the public when developing policies in science, technology, and medicine.

Our work also suggests that use of the terms *nature* and *natural* to express values and beliefs, for example in the media and in advertising, can be ambiguous and potentially misleading for consumers.

In summary

- Different people and organisations use the terms *nature, natural* and *unnatural* in a range of ways when talking about science, technology and medicine.

- The term *natural* is used much more commonly than the term *unnatural* and it is usually used in a value-neutral way. In contrast, when the term *unnatural* is used, it is often used to suggest something is wrong or bad.

- It is not easy to define *natural* or *unnatural* things or processes. Equally, it is not straightforward to classify *natural* things as good and *unnatural* things as bad.

- Some believe that the terms *natural* or *unnatural* do not carry any significance or value and tend not to use them. Organisations representing scientists, for example, rarely use these terms to convey values or beliefs. We call this a *neutral or sceptical* view of naturalness.

- However, we found instances in the media, in Parliamentary debate, in the reports of civil society organisations, and in advertising and labelling of the terms *nature, natural* and *unnatural* being used as placeholders to convey a range of different values, beliefs, ideas, hopes, and anxieties. We have organised these into the following broad themes:

    - *Wisdom of nature:* linked to ideas about the risks attached to novel science and the pitfalls of failing to respect the *wisdom of nature*. It can involve the notion that we should trust in or rely on natural or evolved processes and make use of natural means of reproducing, eating, and healing.

    - *Natural purpose:* concerns what people, animals and plants are meant to do or be like, grounded in natural or evolved functions. This may derive from the natures, functions, or essences of beings, which determine what is good or right for those beings.

- *Disgust and monstrosity:* concerns the kinds of responses that people have to some novel technologies. These may be responses of disgust, repugnance, and revulsion or may be linked to ideas about monstrosity, horror, and references from science fiction.

- *God and religion:* involves the idea that certain technologies serve to distort God's creation or otherwise contravene the will of God.

- The diverse values and beliefs associated with naturalness may mean that people are speaking at cross-purposes – using the same terms with different meanings – when discussing science, technology and medicine.

- It is important that policy-makers understand these values and beliefs if they are genuinely to take account of the views of the public when developing policies for science, technology and medicine.

- The use of the terms *nature, natural* and *unnatural* to express values and beliefs, for example in the media and in advertising, can be ambiguous and potentially misleading.

Recommendations

For individuals

- To avoid us speaking at cross-purposes, we should all be aware that people can use the terms *nature*, *natural*, and *unnatural* as placeholders for a range of different important values or beliefs in relation to science, medicine, and technology.

For organisations representing scientists and other sectors of society

- Organisations which contribute to public and political debates about science, technology, and medicine should avoid using the terms *nature*, *natural* and *unnatural* without conveying the values or beliefs that underlie them.

- Such organisations should explore and engage with the values and beliefs underlying use of the terms *nature*, *natural* and *unnatural* in debates about science, technology, and medicine to ensure that the views of different people are fully understood, debated, and taken into account.

For policy-makers

- Policy-makers, including Parliamentarians, should avoid using the terms *nature*, *natural* and *unnatural* when talking about science, medicine, and technology without conveying the values or beliefs that underlie them.

- Policy-makers should explore fully what people mean when they use the terms *nature*, *natural* or *unnatural* when engaging with the general public to inform the development of science or health policy.

For journalists

- Journalists should avoid using the terms *nature*, *natural* and *unnatural* when talking about science, medicine, and technology without conveying the values or beliefs that underlie them.

For manufacturers and advertisers

- Manufacturers and advertisers of, for example, food, cosmetics and health products should be cautious about describing a product as *natural* given the ambiguity of this term, and that it is unlawful to mislead consumers, and should follow relevant guidance on advertising and labelling accordingly.