Principalism: A Method for the Ethics of Emotion-Oriented Machines

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Abstract This chapter outlines the 'four principles' approach which is prevalent in medical ethics. Principalism was adopted as the ethical method of HUMAINE. This chapter introduces this method and also provides an account of the various criticisms of it. The chapter also includes some discussion of the relationship between ethics and scientific research. The purpose of this discussion is to show how ethics and good ethical research can be embedded in scientific practice. In conclusion, the chapter addresses the importance and the usefulness of considering fears that are embodied in works of science fiction when trying to deal with concerns and fears of the public. Consideration of the ethics of the possible is of massive practical importance and indeed should be a priority for those who are working within research groupings like HUMAINE. It is, however, often important to consider the ethics of what may never be possible – the science fiction if you like. When considering the impossible it will be important to stress the fact that these things are not and may never be possible. The role of this type of consideration lies in the importance of public engagement and showing that possible future scenarios are being taken into account by those who are pushing forward science and technology in this area.

1 Introduction

In this chapter I will give a brief outline of the 'four principles' approach that is prevalent in bioethical discussion. Principalism was adopted as the ethical method of HUMAINE. I will discuss some of the major criticisms of principalism – I do this believing that it is important to be aware of the weaknesses and the strengths. The chapter then goes on to raise some issues about the relationship between ethics and scientific research. In conclusion, the chapter addresses the importance and

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the usefulness of considering fears that are embodied in works of science fiction when trying to deal with concerns and fears of the public. At a discussion held in Manchester we came to the conclusion that when dealing with ethics it may be useful to take a two-strand approach: consider on the one hand the ethics of the possible – this will be of massive practical importance and indeed should be a priority, but it was felt that it will often be important to also consider the ethics of what may never be possible – the science fiction if you like. When considering the impossible it will be important to stress the fact that these things are not and may never be possible. But it is important to consider them anyway as this is a way of dealing with public fears and engaging with those fears fully.

When considering how best to apply ethics to the science and technology which HUMAINE has been developing it is necessary to consider some theoretical issues. These are issues which engineers and scientists should be aware of as they carry out their research:

- Who or what are we considering ethics for?
- Are there more general obligations that we should be aware of, e.g. issues of social responsibility?
- What are the implications of this research?
- What are the aims of the research?
- Is the aim to make autonomous agents and if so what standards of autonomy would have to be reached in order to achieve this?
- If it is not possible to make actually autonomous agents but rather agents that appear to the user to be autonomous then different concerns will be at issue. These concerns will be heightened when these apparently autonomous agents are 'trying' to persuade the agent to act in a certain fashion.

This chapter will act as an introduction to the method of 'principalism', which it is hoped will help guide individuals through questions like these.

2 Principalism

The four principles approach was first championed by Beauchamp and Childress in the 1970s (Beauchamp and Childress, 1979). Also referred to as 'principalism' or the 'Georgetown Mantra', after the institute to which the pair belonged at the time, it has become a standard approach to ethical decision making among healthcare professionals.

> An examiner for the Royal College of General Practitioners membership exam says 'I . . . expect all candidates to not only be conversant with the four principles but also to be able to apply them appropriately'. (Gardiner, 2003)

The approach has been subject to a number of criticisms and its popularity, among ethicists, has seen a decline in the 1990s (Callahan, 2003). However, Beauchamp and Childress's book is now in its fifth edition (Beauchamp and

Childress, 2001). Beauchamp and Childress released the sixth edition of their book in 2008. Raanan Gillon has been the most influential supporter of principalism in England (Gillon, 1985). A trained practitioner as well as a philosopher, for Gillon, the beauty of the approach lies in the fact that he believes that it can provide an easily accessible approach to ethical decision making for those who need it most – medical practitioners. He says:

> As I began to teach using this framework I was impressed by the readiness with which doctors could agree that the four principles were indeed consistent with their own perspective on medico-moral issues. When I lectured more widely I found similar reactions from nurses, other healthcare workers, medical students . . . . (Gillon, 1994a)

Given that many of the individuals involved in emotion-oriented computing will also have a scientific background, it could be suggested that the method will have a similar attraction in this field as it does for clinicians in medicine. Later on in the chapter we will discuss some of the drawbacks of this approach when it is used by those who do not have an ethical background.

3 Beauchamp and Childress on the Four Principles

> Normative ethics is a form of inquiry that attempts to answer the question, 'which general moral norms for the guidance and evaluation of conduct should we use and why?' (Beauchamp and Childress, 2001a)

Beauchamp and Childress see the four principles of beneficence, non-maleficence, autonomy and justice as norms in a universal, common morality (Beauchamp and Childress, 2001b). By this they mean that the principles are so fundamental that they will appeal to 'all persons in all cultures who are serious about moral conduct' (Beauchamp and Childress, 2001c). The principles can be broadly defined in the following way:

- Beneficence implies an obligation to do good for your patient.
- Non-maleficence implies a duty to do no harm.
- Autonomy implies a duty of non-interference, for example, respect for the decision-making capacity of an individual even if the consequences of these decisions are not in their best interests.
- Justice is more problematic to define but at its most basic probably concerns access to health care and just distribution of healthcare resources.

The reason they choose the principles of beneficence and non-maleficence is that they have a long established place in healthcare ethics. The inclusion of autonomy and justice is due to the fact that they have in the past been neglected in medical ethics, but are now considered to be of great importance. The neglect of autonomy can probably be traced to the fact that traditionally paternalism was more acceptable and patients were more willing to defer to the 'better' judgement of their doctor. Justice is increasingly becoming a cause for concern in medical ethics as limits of

available financial resources in health care have a direct effect on its distribution and accessibility.

The choice of these particular principles and their content has been widely criticized as being overly 'American'; I will look at these criticisms later. Beauchamp and Childress wished to create a method for use specifically in the field of bioethics and not a more general ethical theory (Beauchamp and Childress, 2001d). They see the principles as giving rise to prima facie rather than absolute obligations (Beauchamp and Childress, 2001e). Prima facie obligations can conflict with each other and a situation or decision can be both prima facie right and prima facie wrong at once. When this occurs these obligations must be further analysed and weighted against each other to ascertain what is the 'greatest balance' between right and wrong (Beauchamp and Childress, 2001e).

> What agents ought to do is in the end determined by what they ought to do all things considered. (Beauchamp and Childress, 2001f)

Throughout their account of principalism Beauchamp and Childress stress that the approach is not to be taken as a general moral theory. They recognize that alone the four principles are abstract and have insufficient content to deal with most problems in ethical reasoning. They see the principles as providing a framework and the processes of *specifying* and *balancing* build on this framework to move from principles to rules and ultimately decisions (Beauchamp and Childress, 2001f). Therefore when we consider principalism as a method for emotion-oriented machines, we must remember the principles are only the beginning of the method. It provides a framework within which to consider various ethical questions. It should not be seen as an algorithmic method in ethics through which definitive answers can be sought.

Specification plays a central role in principalism. While the principles provide a basis of values, specification removes a layer of abstraction and applies these values to specific issues that give rise to general rules. Specification provides 'action-guiding content' to principalism (Beauchamp and Childress, 2001g). However, it is not enough to create general rules; reasons and justification must also be provided in specification.

> Specification is an attractive strategy for hard cases of moral conflict as long as specification can be justified. Many already specified rules will need further specification to handle new circumstances of conflict. Progressive specification often must occur to handle the variety of problems that arise, gradually reducing the dilemmas and conflicts that abstract principles lack sufficient content to resolve …. All moral norms are, in principle, subject to such specification. They need this further content, because, as Henry Richardson puts it, 'the complexity of the moral phenomena always outruns our ability to capture them in general norms'. (Beauchamp and Childress, 2001h)

As can be seen by this passage, specification is a rigorous and dynamic process. However, the process of specification does not on its own solve conflicts that may arise between principles, as conflicts may also arise between specified rules. Indeed

the process of specification requires the individual to make different judgements about different principles without always giving guidance for these judgements.

While specification deals with the 'range and scope' of each rule and principle, the process of balancing deals with the 'weight and strength' these rules should be given in ethical decision making.

> Moral progress is made through this work of specification, which often involves a balancing of considerations and interests, a stating of additional obligations, or the development of policy. (Beauchamp, 2001)

Balancing is an extension of specification and is not always necessary as some specified rules are taken as absolute. Balancing is important when rules come into conflict with each other and no over-riding interest is easily identifiable. When balancing one rule against the other, reasons must be given and these reasons cannot merely be subjective intuitions for believing one rule more important than the other. They must be morally justifiable reasons. Beauchamp and Childress lay down eight conditions which should be met in the process of balancing (Beauchamp and Childress, 2001i). The processes of specification and balancing will not always give one answer to an ethical problem, but they do not see this as being a weakness in the four principles approach. They say:

> The fact of unresolvable disagreement in some cases does not undermine an expectation that in most cases, the common morality . . . affords us with adequate content to reach agreement or at least an acceptable compromise . . . . What one person may and should do may not be what other persons should do, even when faced with the same problem. (Beauchamp and Childress, 2001k)

Beauchamp and Childress also acknowledge that things other than principles should be taken into account in decision making, for example, 'cultural expectations' and 'precedent', all these factors combine to give weight to one particular outcome over another. In this final process of weighing one particular outcome against the other, Beauchamp and Childress use a method similar to that of Rawls' 'reflective equilibrium' (Beauchamp and Childress, 2001l). This process helps ensure that all the principles and rules used in reaching a decision are as coherent as possible. For Beauchamp and Childress ethical theories should be modified and revised in a manner similar to that of scientific hypotheses (Beauchamp and Childress, 2001m).

> This method requires, as does the associated method of reflective equilibrium, that we match and adjust all of our well substantiated moral judgments in order to render them coherent with the full range of our moral commitments. (Beauchamp, 2003)

4 Some Criticisms on Content and Method

Now that I have given an account of principalism I wish to examine some of the criticisms which have been levelled against it. Takala has questioned whether Beauchamp and Childress are justified in their claim of a common moral language.

She highlights that each principle will be subject to massively different interpretations depending on the context of the society in which they are being considered. This would mean that although the titles of the four principles would remain universal, their content would be hugely varied. Takala gives the following account of the difficulty in defining justice:

> In the spring of 1999, there was again in Finland the time for parliamentary elections. During the campaigns it became obvious that there was an over-whelming consensus among the rival parties that justice is important and that we should aim for a more just society. The only small difference between the parties was the understanding of what justice is and what measures should be taken that justice would prevail . . . same word, but different interpretations of what justly belongs to whom. (Takala, 2001a)

She goes on to show the same difficulty with the other principles. This highlights the fact that only the titles of the principles are universal, their interpretation across cultures and within societies can be diverse. Holm raises similar criticisms about the difficulties of trying to create a universal ethic:

> The fact that common-morality theory necessarily uses the shared morality of a specific society as its basic premise is often overlooked by both proponents and opponents of the four principles. (Holm, 2001a)

This relativity seems to weaken Beauchamp and Childress' claim of a common morality. Holm states that this could be overcome by letting the four principles point to important aspects of morality across cultures but leaving the exact content to be decided within each culture. However, four chapters of *Principles of Biomedical Ethics* are devoted to a description to what the content of each principle should be (Holm, 2001a).

Clouser and Gert focus on this weakness in their criticisms of the four principles (Clouser and Gert, 1990a). They have three main objections to 'principalism'. The first of these is the criticism that the four principles are analogous to a checklist or a chapter heading but that they contain no moral substance. The four principles themselves seem to consist in nothing other than pointers, which may highlight considerations for ethical decision making but provide little guidance in coming to a decision. Beauchamp and Childress openly concede this. They say that it was never their intention that the four principles alone would be sufficient to deal with ethical dilemmas or problems.

> we agree that principles, order, classify and group moral norms that need additional content and specificity. Until we analyze and interpret the principles . . . and then specify and connect them to other norms . . . it is unreasonable to expect much more . . . (Beauchamp and Childress, 2001n)

In light of the above criticisms it would seem that the principles are little more than chapter headings with assorted moral contents in different cultures and societies. Beauchamp and Childress may be overly optimistic in their claim to a global ethic. In their second criticism of principalism, Clouser and Gert state that the four principles provide no guidance to an individual when confronted with a moral problem (Clouser and Gert, 1990b). This lack of guidance leaves the individual free to

give a subjective account of what is to be considered in the problem – they can focus on whatever principle they believe to be the most important and weigh the corresponding rules accordingly. This leads on to Clouser and Gert's third criticism: when two principles come into conflict, principalism is too indeterminate to give an account of ethical decision making (Clouser and Gert, 1990c). In response to this objection Beauchamp and Childress point to the processes of specification and balancing as guiding processes. According to Beauchamp and Childress these processes give structure to the process of ethical reasoning. Takala and Holm point to considerable problems with these processes. The obligations that arise from the four principles are, as I have mentioned earlier, prima facie and this means that they can be discarded if there is good moral reason to do so. However, as Takala points out, 'even this prohibition against breaking a promise turns out to be empty as a universal principle' (Takala, 2001b). What will be considered a morally good reason will be subject to the same relativism in interpretation as the principles are themselves. Holm criticizes the lack of technique involved in the processes of balancing and specification themselves. He claims that Beauchamp and Childress give little criteria as to what should be considered morally relevant in our ethical deliberation.

> Strangely enough the authors of PBE4 seem to see this as a strength of their theory: 'As with specification, the process of balancing cannot be rigidly dictated by some formulaic "method" in ethical theory. The model of balancing will satisfy neither those who seek clear-cut specific guidance about what one ought to do in particular cases nor those who believe in a lexical or serial ranking of principles with automatic overriding conditions'. (Holm, 2001b)

This statement seems to beg the question, what exactly is the purpose of the balancing then? This rejection of a formulaic method seems inconsistent with their previous descriptions of specification and balancing as dynamic processes analogous to scientific revision of hypotheses. Holm also highlights the fact that specification and balancing centre on subjective interpretations of what is important with regard to each of the four principles. The conditions, which are to be met in the process of balancing, are, on Holm's account, 'tautological' at best (Holm, 2001b).

5 What Is the Use of the Four Principles?

At this point I want to ask the questions, how useful is the four principles approach and to whom is it useful? On its own the approach appears to be of limited value; it is therefore not surprising that its supporters stress the fact that it is complementary to and can be used alongside other general moral theories. On Beauchamp and Childress' account, casuistry and accounts of virtues seem to be the favoured bedfellows for principalism. Considerable space is used to highlight the compatibility in *Principles of Biomedical Ethics.* Gillon even believes that principalism has the capacity to bridge the gap between utilitarianism and Kantianism: ethical theories that are generally thought to be in conflict with one another. He tells us:

> The elegance of the four principles approach is that it need say nothing about the deep and some claim untraversable, philosophical chasm separating these two types of philosophical theory – instead it offers each a meeting place in practical ethics. (Gillon, 1994b)

Even if principalism is useful in this respect it requires a basic knowledge of these theories that the majority of the healthcare professionals are not likely to have it would seem that supporters of principalism do not believe that they need it, as Gillon goes on to say:

> Nor, I believe, do all healthcare workers themselves need to try to acquire sufficient philosophical skills to come to a soundly based, well defended philosophical decision about which moral theory they accept as grounding those principles and why they reject all the others. If life long philosophers cannot succeed in this enterprise to the satisfaction of their philosophical opponents it would surely be ludicrous even to suggest that it is appropriate for healthcare workers spending a small part of their student and professional lives on the study of healthcare ethics to attempt it. (Gillon, 1994c)

As a method it may still have much to offer; it highlights four important principles which are worth considering in ethical analysis – however, it is a mistake to think that they are the only principles worth considering. It may provide a valuable method for ethical reasoning in some circumstances, if healthcare professionals, or those working with emotion-oriented computers, have sufficient philosophical knowledge to back up the approach. The biggest problem with principalism is what it does not do: it does not seem to motivate individuals to look beyond the four principles at more general ethical theories and this can only lead to underdeveloped ethical reasoning.

While it may seem at this juncture that I reject the four principles entirely, this is not true – they have many benefits. Time and again it is stated by those involved in clinical practice and ethics committees that the four principles provide a useful starting point. Also many of the criticisms that I have mentioned relate to the fact that medical treatment is often as cultural as it is scientific, and principalism will take on different forms in different cultures – whether these criticisms will be true of the work being carried out by HUMAINE is not yet clear to me. But it is important when considering any methodological approach to be aware of the perceived downfalls as well as the merits of the approach.

6 Some General Considerations

Science can move at astounding paces so it is important to try to pre-empt problems before they arise – this is so even if we sometimes have to delve into the realms of what is at present fiction. It will be better to have given prior consideration where possible. This is especially important when we are trying to gain public confidence in the work being carried out. Careful consideration should be given to how the possible results of research are presented. Scientists are often under huge pressure to get funding and the best way to do this is to present the best possible outcomes of their research. However, caution should be exercised. We have seen time and time again

in the field of biotechnologies the presentation of the next 'panacea'. At present it is arguably stem cell therapies. While stem cell therapies may provide many astounding therapies the science is far from certain and this should be acknowledged. Again this will help with public perception of the sciences and allow for honesty and transparency. Also there should be on both sides a wariness to walk the road of either 'scientific imperatives' or 'precautionary principles'. That we can do something will not always imply that we should, and similarly epistemic uncertainty need not automatically give rise to the conclusion that we should not.

Another general point to consider is that when creating interactive machines, there must be an awareness of the ethical issues that will arise between the user and the machine. When machines are not themselves capable of ethical reasoning, many of the responsibilities will lie with the programmer. It is the programmer who must consider what it is they wish their machine to do and what possible effects this may have on users. It is also important to be aware of how the machines could be misused by others in the future, for example machines with the capacity to deceive the user may be able to cause the user much harm. If it is a persuasive agent, the machine may challenge the user's autonomy.

7 Separating Science from Fiction

Discussion of biotechnologies is often permeated with fears of these technologies; often these fears are illustrated by reference to works of fiction. In many of these, biotechnologies are often highlighted for the manner in which they can be abused and thus lead to a breakdown in social order. So if we look at one of the most famous books on the topic, *Brave New World* by Aldous Huxley, we see how society could be transformed by biotechnologies into a place where the norms and values we now have are alien (Huxley, 1994). Similarly the film *GATTACA* depicts a world in which a genetic underclass is created and although ultimately the system is effectively beaten by the 'defective' this is seen as triumph against biotechnologies (Niccol, 1997). Again in the film *The Island* we see how industry could exploit biotechnologies for profit and effectively create human beings in order to take their organs at some later stage (Bay, 2005). These are examples and there are many other works that could be cited. What can be taken from them is the fact that society does have concerns about technologies, although perhaps not as dramatic as these works would imply. These fears should therefore be acknowledged and accounted for and bioethical arguments should hope to answer/dissuade them. These works are the materials that fuel the myths surrounding biotechnologies.

We can learn a lot from fictional works if we accept the idea that they are a manifestation of the fears that people have with regard to biotechnologies. We can see similar fears of computer technologies. These fears are heightened when considering those technologies that aim to create smarter, more human like machines. Consider the films *I, Robot* (Proyas, 2004) and *Artificial Intelligence:*

A.I. (Spielberg, 2001) as examples. These works illustrate the fears that individuals have about 'clever' computers. However, a fine line must be walked between addressing concerns and the over-indulgence of the impossible.

8 Conclusion

So in conclusion when we use principalism as a method we are by no means confined by the approach championed by Beauchamp and Childress and indeed this may not be the most appropriate vehicle. However, there will be many things we can learn from the criticisms that have been levelled at their model. Their account can be amended and improved to better accommodate the needs of those working with emotion-oriented machines. Finally it will be in the interests of those working with emotion-oriented machines to identify and address the fears that the public may have about the technologies that are being developed – even though these fears may be based in fact but illustrated and perpetuated by fiction. In biotechnology there has often been unnecessary controversy and backlashes against certain breakthroughs – these could be avoided if careful consideration is given to the fears that fuel these reactions.

In spite of all the criticisms outlined above, principalism has many attractions, primarily the fact that as a method it is just intended to encapsulate our commonsense morality. Commonsense morality is not aiming to deliver up answers algorithmically and so in that sense the criticism of principalism is misplaced. The theoretical approach of HUMAINE is that of commonsense morality as embodied in principalism. Within the principles we find simply an account of everyday common sense that can be used to achieve the best outcome to any problems that may arise. This will help the researchers involved in this project to think sensibly in terms of ethics – something that it can be seen has been achieved so far. When it appears that the principles conflict with each other or are mutually incompatible it will be necessary to consider background conditions. Situations should always be considered in the appropriate context, which is not to say that we should give way to relativist accounts of 'anything goes'. These principles act merely as 'rules of thumb' and it may not always be necessary to consider all four in every situation. They do, however, provide a clear framework that can be used methodologically.

While it is important to be aware of the ethical issues involved in emotion-oriented computing one must not be *too* aware of them. Whether human–machine interaction can create genuinely novel situations is arguably unlikely, the principles of beneficence, non-maleficence, autonomy and justice will provide a solid framework within which different possible outcomes can be examined. When considering the uses of automated machines it is important to remember the general guidelines that apply in that field, for example when creating persuasive machines for use in the advertisement industry there may be advertising standards or regulation of advertising methods which must be abided by. There should not be a presumption that novel situations or technology necessarily lead to novel ethical issues.

References

Bay M (2005) The Island. DreamWorks SKG
Beauchamp T (2001) Principalism and it's alleged competitors. In: Harris J (ed) Bioethics. Oxford University Press, Oxford, p 82
Beauchamp T (2003) Methods and principles in biomedical ethics. J Med Ethics 29:269
Beauchamp TL, Childress JF (1979) Principles of biomedical ethics, 1st edn. Oxford University Press, New York, NY
Beauchamp TL, Childress JF (2001) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY
Beauchamp TL, Childress JF (2001a) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 2
Beauchamp TL, Childress JF (2001b) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 3
Beauchamp TL, Childress JF (2001c) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 4
Beauchamp TL, Childress JF (2001d) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 23; Beauchamp T (2001) Principalism and it's alleged competitors. In: Harris J (ed) Bioethics. Oxford University Press, Oxford, p 480
Beauchamp TL, Childress JF (2001e) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 14
Beauchamp TL, Childress JF (2001f) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 15
Beauchamp TL, Childress JF (2001g) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 16
Beauchamp TL, Childress JF (2001h) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 17
Beauchamp TL, Childress JF (2001i) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 20
Beauchamp TL, Childress JF (2001j) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 385
Beauchamp TL, Childress JF (2001k) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 22
Beauchamp TL, Childress JF (2001l) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 397
Beauchamp TL, Childress JF (2001m) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 399
Beauchamp TL, Childress JF (2001n) Principles of biomedical ethics, 5th edn. Oxford University Press, New York, NY, p 19
Beauchamp TL, Childress JF (2008) Principles of biomedical ethics, 6th edn. Oxford University Press, New York, NY
Callahan D (2003) Principalism and communitarianism. J Med Ethics 29:287
Clouser KD, Gert B (1990a) A critique of principalism. J Med Philos 15:279–310
Clouser KD, Gert B (1990b) A critique of principalism. J Med Philos 15:383
Clouser KD, Gert B (1990c) A critique of principalism. J Med Philos 15:391
Gardiner P (2003) A virtue ethics approach to moral dilemmas in medicine. J Med Ethics 29:297
Gillon R (1985) Philosophical medical ethics. Wiley, Chichester; Gillon R (ed) (1994) Principles of healthcare ethics. Wiley, Chichester
Gillon R (1994a) The four principles revisited – a reappraisal. In: Principles of healthcare ethics. Wiley, Chichester, p 319
Gillon R (1994b) The four principles revisited – a reappraisal. In: Principles of healthcare ethics. Wiley, Chichester, p 321

Gillon R (1994c) The four principles revisited – a reappraisal. In: Principles of healthcare ethics. Wiley, Chichester, p 325
Holm S (2001a) Not just autonomy: the principles of american biomedical ethics. In: Harris J (ed) Bioethics. Oxford University Press, Oxford, pp 494–506
Holm S (2001b) Not just autonomy: the principles of american biomedical ethics. In: Harris J (ed) Bioethics. Oxford University Press, Oxford, pp 504
Huxley A (1994) Brave new world. Flamingo, London
Niccol A (1997) GATTACA. Columbia Pictures, Columbia, SC
Proyas A (2004) I, Robot. 20th Century Fox
Spielberg S (2001) Artificial intelligence: A.I. Warner Bros. Picture
Takala T (2001a) What is wrong with global bioethics? On the limitations of the four principles approach. Camb Q Healthc Ethics 10:72–77
Takala T (2001b) What is wrong with global bioethics? On the limitations of the four principles approach. Camb Q Healthc Ethics 10:76