LIFESPAN EXTENSION AND THE DOCTRINE OF DOUBLE EFFECT

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INTRODUCTION

During the past century, the developed world has witnessed an important shift in disease patterns. Degenerative diseases have replaced infectious and parasitic diseases as a major cause of death. This phenomenon is commonly referred to as the 'epidemiologic transition'. As degenerative diseases tend to occur at a much older age than infectious diseases, this transition amounts to a redistribution of diseases and deaths from the young to the old [1]. If we are to further increase the healthspan – i.e. the number of years spent in a disease-free state – we will have to devise means for combating age-related diseases. There are two distinct approaches to tackling these pathologies.

A first approach consists of the traditional prevention and treatment of age-related diseases. This piecemeal strategy, in which the diseases of ageing are addressed *individually*, is known as the 'weak' approach [2]. This terminology refers to the latter's limited impact on the healthspan and maximum lifespan[1]. The last stage of life sees an exponential increase in the incidence of most age-related diseases. Consequently, once any one of the lethal diseases is eradicated, it is only a matter of time before its place is taken by yet another. Scientists, therefore, concur that, whereas this approach is likely to increase the healthspan, the increase will be of a small magnitude. Furthermore, they agree that an increase in the maximum lifespan is highly improbable [4]. Any such increase that would occur, would be only minimal.

A second strategy, known as the 'strong' approach [2], is to intervene in the *ageing process itself* – the underlying cause of age-related diseases. This entails that all age-related pathologies are dealt with *simultaneously*. As a result, this approach guarantees a substantial increase in the healthspan and maximum lifespan [4]. Although we are currently unable to intervene in the human ageing process, biogerontology – the study of the biology of ageing – offers a promising route to achieving this. Researchers are currently conducting molecular genetic studies of long-lived subjects [5]. In the long run, these studies may enable us to target the genes involved in the most severe types of age-dependent decay. Caloric restriction represents another important area of research for biogerontologists. It has been observed that a regimen of 40% reduction in calories significantly extends both the healthspan and the maximum lifespan of mice, rats and invertebrates [6]. Although the study of caloric restriction

[1] The current maximum human lifespan is 122 years [3].

in humans is still in its infancy, the available data look fairly promising (see, for example, [7]). However, even if caloric restriction proves successful in humans, it will most probably not be viable in practice. Most humans would find it difficult, if not impossible, to adhere to the required limitations in caloric intake. For this reason, scientists are trying to develop caloric restriction mimetics, substances which mimick the beneficial effects of caloric restriction while avoiding the need for dietary restrictions [8].

Biogerontologists disagree to what extent the ageing process is malleable. Whereas some consider the deceleration of the ageing process to be the ultimate outcome of biogerontological research, others envisage the more radical scenario of 'arrested ageing'.

The deceleration of the ageing process would markedly postpone the development of old-age frailty and its accompanying diseases, thereby producing an increase in both the healthspan and maximum lifespan [9]. Interventions such as caloric restriction appear to decelerate ageing. Extrapolating from the findings in animal models, Richard Miller [6] anticipates that the deceleration of the human ageing process will bring about an average life expectancy of 112 and a maximum lifespan of 140.

Arresting the ageing process would be tantamount to achieving total mastery of the ageing process in that its harmful effects – age-related diseases – would no longer occur. This approach involves the continuous repair of the molecular and cellular damage responsible for the onset of age-related frailty. The aim is to repair the damage before it reaches a level at which it induces age-related pathologies. Aubrey de Grey [10], one of the strongest advocates of the feasibility and desirability of arrested ageing, has identified seven types of damage which accumulate with age. Suggested therapies for repairing the damage range from genetic interventions to stem cell therapies. Although de Grey [10] acknowledges that these fixes will initially be imperfect, he expects the added years to be sufficient for us to develop improved fixes. The latter, in turn, would provide us with still more life years, enabling the production of still better repair methods, and so on. As long as we keep developing new, improved therapies fast enough, we should be able to postpone age-related diseases *indefinitely*. As these pathologies would no longer occur, a state of 'virtual immortality' would be attained in the sense that death would only result from accidents, suicide, wars, and so forth [11].

The biogerontological project is met with strong resistance, especially by deontologists. In a bid to convince the latter of the permissibility of intervening in ageing, proponents of biogerontology appeal to the doctrine of double effect. Surprisingly, their argument has gone unnoticed. Our aim in this paper is to expose and critically evaluate this argument. But before we embark on this mission, we should briefly give an account of the doctrine of double effect.

DOUBLE EFFECT IN CONTEMPORARY BIOETHICAL DEBATE

The doctrine of double effect (henceforth just 'DDE') was originally invoked as a solution to an action problem, where an absolute[2] deontological principle prevents actions which are good, or even morally required [13]. Such a problem occurs, for example, when an agent wishes to engage in self-defence so as to protect her own life, but cannot do so without killing her assailant (i.e., without infringing the prohibition against killing human beings). In short, the DDE has evolved as a means of resolving situations where an agent wishes to do good, but cannot do so without causing serious harm. The DDE attempts to solve this problem by stating that it is sometimes permissible to bring about such harm, provided that it is a foreseen, but unintended side-effect of promoting some good end.

Focusing on action problems introduced by the prohibition against killing human beings, Bica [13] describes the function of the DDE as follows:

> The DDE, then, "redefines" the scope of the absolute prohibition's [the prohibition against killing human beings] application. That is, by focusing upon the moral significance of intention and its relevance to moral agency and responsibility, it morally distinguishes "accidental" killing from murder, claiming that only the latter is absolutely prohibited. Consequently, while alleging to preserve the absolute nature of the prohibition, with the application of the DDE, it is sometimes permissible to knowingly kill [...] human beings – if only one withholds intention. [13, p. 131]

Disagreement about the meaning and function of the DDE has resulted in various formulations of the doctrine. These formulations have in common the idea that the permissibility of bringing about certain kinds of harm hinges on a number of conditions being met. Since it is not our aim to discuss the validity of the DDE, we will simply use Joseph Mangan's formulation[3], a plausible and, in medical ethics, influential version of the doctrine. According to this formulation, for an action which has at least one good and one bad consequence to be permissible, four conditions need to be met:

(1) That the action in itself from its very object be good or at least indifferent;
(2) That the good effect and not the evil effect be intended;
(3) That the good effect be not produced by means of the evil effect;
(4) That there be a proportionately grave reason for permitting the evil effect. [17, p. 43]

Note that actions which satisfy all of these conditions are 'merely' *permissible*; the DDE imposes no moral *obligation* to perform such actions. The DDE only entails an obligation when dealing with actions which do not meet at least one of the above conditions. The latter type of actions are

[2] Note that, despite its origin being absolutist, non-absolutist accounts of the DDE have also been put forward (see, for example, [12]).

[3] Note that there exist newer versions of the DDE (see, for example, [12, 14-16]). Our discussion throughout this paper is relative to Mangan's version.

impermissible, i.e. one has an obligation to refrain from such actions. Thus, the DDE has more force as a prohibitive principle than it has as a permissive principle [18].

The DDE has important applications within medical ethics and clinical practice. One of the most common applications occurs in the abortion context, where its use is generally illustrated with a pair of contrasting cases: the hysterectomy and the craniotomy case. In the hysterectomy case, a pregnant woman has cancer of the uterus. A hysterectomy is required to save her life. The craniotomy case features an unborn child, whose head is lodged in the mother's birth canal. If the head is not dislodged, the mother will die. The head can only be dislodged through a craniotomy (crushing of the unborn child's head). Below, we present a commonly encountered approach to both cases. Alternative analyses are possible [14]. However, it is not our intention to endorse one or other approach. The discussion of these cases merely serves the purpose of *illustrating* the use of the DDE.

In both the craniotomy and hysterectomy case, the action under consideration has the same positive (the mother's life is saved) and negative (foetal death) effect. However, important differences between these cases become apparent once we apply the four conditions specified by the DDE:

(1) While performing a hysterectomy is in itself good or neutral, this does not hold true for the crushing of the unborn child' s skull.

(2) The assessment of this condition is generally approached in one of two ways. Some (e.g. [19]) believe that this condition rarely poses a problem when dealing with medical applications of the DDE as we may reasonably assume that medical professionals are not malevolent. Proponents of this view would, thus, argue that, in both the hysterectomy and the craniotomy case, only the good effect of preserving the mother's life is intended. Others, however, reject this baseline assumption of benevolent intention. Beauchamp and Childress [20], for example, argue that one cannot but intend the bad effect of foetal death when performing a craniotomy. They reason that foetal death is a means (see condition (3) below) to save the pregnant woman's life. A means to one's end, they argue, is always intended.[4]

(3) The removal of the uterus, not the death of the child, is what saves the mother's life in the hysterectomy case. Thus, the hysterectomy case satisfies the third condition. However, the craniotomy case does not. Since crushing the child's skull amounts to killing the baby, the good effect of preserving the mother's life is obtained through the bad effect.

(4) The hysterectomy case satisfies the proportionality requirement in that saving the mother's life constitutes a proportionate reason for allowing the child to die. Leaving aside the difficulty that *killing* could affect proportionality differently than *allowing to die*, we may suppose that the fourth condition is also met in the craniotomy case [18].

[4] We analyze this line of reasoning in greater detail further on in this paper (see p. 12).

The above analysis suggests that the hysterectomy case satisfies all four conditions of the DDE, whereas the craniotomy case does not. Thus, according to the generally held view, the hysterectomy is permissible, whereas the craniotomy is prohibited under the DDE.

The DDE also plays an influential role in the debate about end-of–life decisions. It has been invoked to justify the administration of pain-relieving medication to terminally ill patients in doses which would most probably hasten death, but where the death is an unintended side-effect of administering the medication. It distinguishes such actions from euthanasia and assisted suicide, in which the death of the patient is a means to reduce suffering [21].

As mentioned earlier, the DDE is a controversial doctrine, and has been discussed extensively. The issues discussed range from the moral relevance of the intended/foresight distinction to the precise formulation of the principle [19]. However, these issues lie beyond the scope of this paper. We will only touch upon them insofar as they are relevant for the purpose of our paper.

DOUBLE EFFECT IN THE ETHICAL DEBATE ON BIOGERONTOLOGY

In this section, we first examine three passages from the debate on the merit of various approaches to tackling age-related diseases. Next, we argue that the authors of these passages engage in double effect reasoning, albeit only implicitly. Finally, we analyze the role which the argument appealing to the DDE is meant to fulfil. We claim that the argument, which we will refer to as the 'double effect argument', is appealed to by proponents of biogerontology in order to reach out to some of their (deontological) opponents: those who adhere to double effect reasoning.

A first excerpt is from the work of John Harris:

> Remember that immortality is not unconnected with preventing or curing a whole range of serious diseases. It is one thing to ask whether we should make people immortal and answer in the negative; quite another to ask whether we should make people immune to heart disease, cancer, dementia, and many other diseases and decide that we shouldn't, because a "side effect" of the treatment would be an increase in life expectancy. We are then, unlikely ever to face the question, Should we make people immortal: Yes or no? We may rather be called upon to decide whether we should treat this disease when we know an effective treatment will extend lifespan. It might then be appropriate to think of immortality as the, possibly unwanted, side effect of treating or preventing a whole range of diseases. Could we really say to people, "You must die at the age of 30 or 40 or 50, because the only way we can cure you is to make you immortal or let you live to be 200 or 300"? [22, p. 10]

An implicit appeal to double effect is also present in the work of David Gems:

> Decelerating human ageing would have two outcomes that are very different in ethical terms. Firstly, it would greatly reduce the frequency of ageing related illness at any given age. (…) Secondly, it would lead to extended lifespan – perhaps, eventually, of a large magnitude. (…) Yet, the possibility of very large increases in lifespan – let us say, for argument's sake, to 150 years - is one that many find unnerving. (…) But given the health benefits of decelerated ageing, although we may not particularly want life extension (…), we may simply have to accept it as a side effect of a greater benefit. [23, p. 111]

Aubrey de Grey also implicitly refers to the DDE:

> (…) the only realistic approach to greatly postponing bad deaths is to combat aging itself, (…) thereby (…) greatly raising life expectancy, with all that that entails. The question that humanity must face up to is clear: is the prevention of the suffering currently associated with most deaths from old age valuable enough to justify the inevitable side-effect of radically increased lifespans? The question is not whether that side-effect is good or bad – a question on which opinions will surely remain divided for some time to come. The question, rather, is whether that side-effect is *so* bad as to outweigh the benefits of eliminating aging-related suffering. [24, p. 3]

The above passages exhibit a common structure in that they feature an action with a good and a bad effect. In each case, the identified bad effect is a (radically) increased maximum lifespan. Concerning the action at play, it is clear that both Gems and de Grey are discussing the 'strong' approach to tackling age-related diseases, i.e. the act of intervening in the ageing process itself. After all, de Grey speaks of combating "ageing *itself*". Gems, on the other hand, refers to "decelerating human ageing", a recognized instance of intervening in ageing. In Harris' case, the reference to "treating or preventing a whole range of diseases" initially suggests that he is discussing the 'weak' approach. However, on closer inspection, he appears to be using the latter phrase as a misnomer for the 'strong' approach. Harris speaks of the bad effect in terms of "immortality". As noted in the introduction, an increase in maximum lifespan of this magnitude can only be achieved through the 'strong' approach. Harris' reference to the good effect as "immunity to age-related diseases" further supports our claim that he is indeed addressing interventions in the ageing process. Such immunity after all, is only achievable through the 'strong approach'. Let us now turn to the good effect identified by Gems and de Grey. They respectively speak of "greatly reducing the frequency of ageing related illness at any given age" and "the prevention of the suffering associated with old age". Despite the differences in the

terminology employed by these authors in reference to the good effect, there appears to be a common denominator. All of the identified good effects amount – as these authors themselves acknowledge - to the (indefinite) postponement of age-related diseases. The common structure of the above passages is illustrated in Fig.1.

[**Fig. 1** common structure of the passages]

Establishing the presence of the DDE

In featuring an action with a good and a bad effect, the quoted passages incorporate a basic characteristic of double effect reasoning. However, more is needed in order to establish the presence of the DDE. The key characteristic of double effect reasoning is the intended/unintended distinction. Below we argue that Gems, de Grey, and Harris appeal to this distinction, albeit implicitly.

There is a broad consensus among proponents of biogerontology that the field's *goal* or *objective* consists in increasing the human healthspan (see, for example, [25, 26]). Terms such as 'goal' and 'objective' undeniably denote intention. As they are ardent proponents of biogerontology, Gems, de Grey, and Harris very likely endorse the claim that interventions in ageing are intended to increase the healthspan. The good effect which these authors refer to in the quoted passages amounts precisely to an increase in the healthspan. Thus, when Gems, de Grey and Harris mention this good effect, we may reasonably interpret them as saying that this is the intended effect of intervening in ageing. The fact that they juxtapose the good effect with an *unwanted* bad effect further strengthens our claim that the good effect is what they consider to be the intended effect.

We have established the presence of the first component of the intended/unintended distinction, i.e. the fact that the good effect is intended. Are there any grounds to interpret the bad effect as referring to an unintended effect? As suggested above, the term 'unwanted', which is used in reference to the bad effect, could be considered as denoting a lack of intention. However, there is another, much more sound basis for inferring the presence of the intended/unintended distinction. According to Cavanaugh [27], the latter distinction can interchangeably be referred to as the 'intended/side effect' distinction. Gems, Harris, and de Grey each refer to the bad effect in terms of a side effect. This, combined with the already established presence of a good, intended effect, implies that the quoted passages contain the characteristic distinction of the DDE.

[**Fig. 2** structure of the 'double effect argument']

The role of the 'double effect argument'

Advocates of biogerontology face strongest opposition from those whose beliefs are grounded in deontological arguments. Many deontologists consider the act of intervening in the ageing process impermissible on the grounds that it brings about an extended maximum lifespan – a state of affairs which they deem intrinsically bad [28]. [5] Most proponents of intervening in the human ageing process do not themselves adhere to the DDE. Thus, in appealing to this deontological model, the latter seemingly attempt to win over their aforementioned opponents. In sum, advocates of biogerontology hope to convince their deontological opponents of the permissibility of intervening in ageing by framing this act within the DDE. In light of its rhetorical purpose, how exactly should we understand the double effect argument? We should *interpret* those appealing to this argument as saying the following: "Deontologists claim that an extended maximum lifespan is a bad state of affairs. Anyone would agree that there is much value in having age-related diseases postponed. The latter can be achieved by intervening in the ageing process. Admittedly, such interventions would also bring about an extended maximum lifespan, thereby breaching a deontological prohibition. Does this imply that deontologists necessarily ought to condemn the act of intervening in the ageing process? No. Once we frame this act within the DDE, it becomes permissible. After all, the act of intervening in ageing is morally neutral. The extended maximum lifespan (the bad effect) is an unintended effect of intervening in ageing. The intention is merely to bring about the good effect, i.e. the postponement of the onset of age-related diseases. In addition, the bad effect is not a means to the good effect. Finally, there is a proportionately grave reason for permitting the bad effect."

As noted above, many deontologists consider an extended maximum lifespan a bad state of affairs. When defending their position on this matter, deontologists differ somewhat in the aspects which they emphasize [29].

A first group appeals to human nature (see, for example, [30, 31]). The good is that which conforms to human nature, whereas the bad is that which represents a perversion of the latter. Leon Kass is one of the most renowned proponents of this view. With regard to the issue at hand, he asks: "Is it really true that longer life for individuals is an unqualified good?" [32: 309]. His answer is a clear "no". Not only is an extended life not an unqualified good. It is, according to Kass, an evil. He states his view of an increased lifespan being inconsistent with human nature as follows:

> For to argue that human life would be better without death is, I submit, to argue that human life would be better being something other than human. To be immortal would not be just to continue life as we mortals know it, only forever. The new immortals, in the decisive sense, would not be like us at all. [32: 311]

[5] Note that, as we argue further on, deontologists do not (necessarily) consider the act of intervening in ageing as bad in itself.

As Kass himself acknowledges, when he speaks of "life without death", he is not merely referring to immortality. The phrase also denotes modestly extended lifespans. Kass suggests that, for example, a lifespan only 20 years longer than the current one, may already constitute a deviation from human nature. Callahan defends a view somewhat similar to Kass' [33]. In answer to the question: "What should be an acceptable span of life (...)?", Callahan refers to the 'natural lifespan' [33: 66]. The latter more or less corresponds to the current lifespan. Besides it being unnatural, Callahan also rejects an extended lifespan on the grounds that it would have adverse social consequences.

A second group of deontologists appeals to the concept of the 'life cycle', the normative natural order present in life's events and in their pacing in an individual's life [34]. An extended lifespan, according to this view, represents an unacceptable disruption of this order. Life cycle traditionalism also appeals to the concept of human nature – albeit merely indirectly – in that it views the life cycle as an important characteristic of all living organisms. Thus, in breaking with the life cycle, an extended lifespan compromises the essential identity of human beings.

TESTING THE SOUNDNESS OF THE 'DOUBLE EFFECT ARGUMENT'

The question remains whether those who appeal to the 'double effect argument' would succeed in winning over their deontological opponents. The argument will only be successful if these deontologists view the act of intervening in ageing as satisfying each of the 4 conditions of the DDE. Below, we reconstruct the way in which deontological opponents of biogerontology are likely to assess interventions in ageing against the standard of the DDE.

Condition 1: is the action in itself morally good or neutral?

Is intervening in the ageing process a good or at least morally neutral action, independent of its consequences?

Some deontologists will *a priori* reject interventions in the ageing process on the grounds that ageing is not a disease; it is a normal process that should not be intervened in. In short, on this view, interventions in the ageing process are unacceptable as they constitute 'enhancement', not 'therapy' [28].

Deontologists, such as Kass, who are primarily concerned with preserving human nature may accept *natural* interventions in the ageing process. We have described the action to be justified as 'intervening in the ageing process', but there are different ways of doing so. For example, one could do this by administering a drug that switches on a gene associated with longevity, or one could intervene in the ageing process using caloric restriction. Whether a deontologist concerned with preserving human nature regards a certain intervention in the ageing process as good or neutral will

depend on how she understands 'unnatural'. If 'unnatural' is understood as all that is human-made, then she may accept caloric restriction but reject all medical-technical interventions. However, given the radical implications of this view (i.e. the need to renounce medicine altogether), few deontologists would advocate this interpretation of 'unnatural'. Another, for deontologists more plausible view, equates 'unnatural' with a significant deviation from 'normal' processes; in this case from 'normal' bodily functioning. Caloric restriction (mimetics) could then be accepted because it respects the normal bodily processes, whereas gene therapy would be rejected. When we deprive the body of food, as is the case in caloric restriction, we merely trigger a programmed reaction in the body. Obviously, caloric restriction mimetics would trigger the very same reaction. However, in the case of gene therapy, we are reprogramming the body's normal reaction, rather than addressing its latent potential.
'Life cycle traditionalists' will most probably reach the same verdict as those concerned with preserving human nature. After all, as noted above, they too draw upon the concept of human nature, albeit implicitly.

One may object to this analysis by pointing out that one can always redescribe the action to be justified in such a way that it *is* neutral or good, and, thus, always meets the first condition. This is the 're-description problem' first mentioned by Philippa Foot [35]. The problem is that the first condition separates the action from its effects or consequences. It stipulates that the action *in itself* has to be good or neutral, independent of its effects or consequences. But if we have to consider the action independent of its effects, we can always describe it in a neutral way. For example, in the infamous craniotomy case, the action could be described as killing the foetus, but also as reducing the size of the foetus's skull. Likewise, one could describe the action 'intervening in the ageing process through genetic manipulation' as 'administering a drug' with one side-effect that a gene associated with the ageing process is switched off and another side-effect that an extended maximum lifespan is obtained. The action to be justified might then be considered good or neutral by deontologists. One proposed solution to this problem is to implement a criterion of closeness, linking intended actions to their closely related side-effects so that they are inseparable from the action. Since the drug works by switching off a gene that plays a crucial role in the ageing process, it surely is more plausible to describe the action as 'a genetic intervention in the ageing process'. It is plausible that one cannot separate the means used (i.e. the drug) from the mechanism (i.e. switching off a gene) through which the means works.
So depending on the mechanism involved, some deontologists will not consider the action to be justified as good or neutral. If condition 1 is not met, then the argument appealed to by defenders of biogerontology to convince some of their opponents will not hold. However, for those deontologists who regard the action as neutral or good, the argument could still work if the other conditions are met.

Condition 2: is the bad effect unintended?

Does the agent only intend the good effect? Is the bad effect – the extended maximum lifespan – merely a foreseen but unintended side-effect? Before answering these questions, we would like to address a common misconception. The DDE is sometimes interpreted as making the permissibility of an action turn on the *actual* intentions of a *particular* agent (see, for example, [36-38]). According to this interpretation, the act is permissible when the individual performing it merely intends the good effect. Conversely, the act becomes impermissible when conducted by an individual who intends the bad effect. FitzPatrick [39] has convincingly refuted this interpretation of the DDE. According to FitzPatrick, the requirement which needs to be met in order for condition 2 to be satisfied, is situated on an abstract, theoretical level – as opposed to the practical level of the particular individual and her intentions. All that is required for condition 2 to be met, is that it is *theoretically conceivable* that one acts without intending the bad effect. Thus, where a *particular* agent acts with malevolent intentions, condition 2 could still be met. What matters for an act to be permissible is that one *could* act without intending the bad effect. Conversely, condition 2 is violated when, *whatever the circumstances considered,* one cannot but act with malevolent intentions.

Controversy exists about how to determine whether an effect of an action is an *intended* effect [40]. A commonly applied test to account for the distinction between intended and merely foreseen effects is the counterfactual test [41]. This test asks whether an agent would still do the act if she thought that the bad effect would not occur. If the non-occurrence of the bad effect would deter the agent from performing the relevant action, we may conclude that she intends the bad effect. In light of our abovementioned remark, the agent referred to in the counterfactual test should be interpreted as an agent 'in the abstract', rather than a particular agent. Applied to the question at hand, the counterfactual test goes as follows: can a doctor who intervenes in the ageing process reasonably say that if she could do so without obtaining an extended maximum lifespan, she would? We believe that she could. Suppose that a patient has a genetic predisposition for developing an age-related disease, or a set of age-related diseases. Furthermore, suppose that a doctor knew that, if she intervened in the patient's ageing process, the onset of the age-related disease(s) would be postponed, but the patient's life would not be extended beyond the maximum lifespan (say, because her patient is a Death Row inmate). It is plausible that the doctor would still perform the action – intervening in the ageing process – if this is the most efficient, or the only way of postponing the (set of) age-related disease(s). Does our Death Row scenario provide sufficient grounds for concluding that condition 2 is met? Recall that condition 2 is violated when, *whatever* the circumstances considered, an agent intervening in the ageing process necessarily intends the bad effect. Conversely, then, condition 2 is met when one can conceive of at least one case – set of circumstances – under which one *could* intervene in the

ageing process without intending the bad effect. Our Death Row scenario provides precisely such a counterexample.

Condition 3: is the bad effect used as a means to the good effect?

Is the extended maximum lifespan a means to the (indefinite) postponement of age-related diseases? The general idea behind this condition is that a harm that might permissibly be brought about as a side- effect in promoting a good end could not be permissibly brought about *as a means* to the same good end.

There are two ways of approaching the assessment of this third condition, depending on how one views its relationship to the second condition. While some consider both conditions as interchangeable, others regard them as separate conditions which cannot be reduced to one another. Below, we determine, from each of these perspectives, whether the third condition is satisfied.

Marquis [40], who advocates the interrelatedness between the second and third condition, argues as follows:

> In general, if Mangan's condition (3) is violated, then the good effect is produced by means of the evil effect. If we grant the doctrine that he who intends the end also intends the means, then the evil effect is intended. And if the evil effect is intended, then condition (2) is violated. Hence, if condition (2) is satisfied, then so is condition (3). [40, p. 520]

Following this line of reasoning[6], we can simply deduce whether or not the third condition is met from our findings regarding the second condition. In our analysis of condition 2, we have established, using the counterfactual test, that the bad effect, i.e. the extended maximum lifespan, is unintended. Therefore, since one's means are always intended, the bad effect cannot be a means to the good effect (i.e. the (indefinite) postponement of age-related diseases). In sum, the third condition is met on this view.

Is the third condition met from the perspective of those who repudiate its interconnectedness with the second condition? On this view, both conditions differ clearly in that the second asks whether the bad effect is intended *as an end*, whereas the third inquires whether it is intended *as a means*. How does 'intending as an end' differ from 'intending as a means'? It has been argued that if an agent believes that her action has a certain direct effect and this belief is the rationale behind her action, the agent intends this effect as an end [19]. For example, if I write a book because I believe it will make me

[6] Note that Beauchamp and Childress [20] appeal to this line of reasoning in their analysis of the craniotomy case. From the fact that the bad effect (the death of the foetus) constitutes a means to the good effect (preserving the mother's life), they deduce that the bad effect must be intended.

famous, then I intend becoming famous as an end. The concept of 'intending as a means' amounts to the following: "If an agent believes that φ -ing [where φ stands for some verb of action] has a certain effect (E_1) and believes that E_1 is related (causally or otherwise) to another effect (E_2) and the latter belief is a reason for her to φ, then the agent intends E_1 as a means to E_2 and she intends E_2 as an end" [19, p. 468-469]. Suppose that a murderer turns herself in. She believes that this will lead to her being executed, which in turn will relieve her of the remorse that haunts her. The murderer, then, intends her being executed as a means to ending her psychological suffering, which she intends as an end.

On this view, the fact that the second condition is satisfied 'merely' tells us that the bad effect (the extended maximum lifespan) is unintended as an end. This, in itself, does not give anything away concerning the third condition as the bad effect may very well be unintended as an end, yet intended as a means. We, therefore, need a way of independently assessing whether or not the bad effect constitutes a means to the good effect. Several tests have been proposed. Below, we apply two widely applied tests to the case at hand. We show that, on both tests, the bad effect (extended maximum lifespan) is not a means to the good effect.

A first test is the 'inevitable connection test' [40]. According to this test, if the action is inevitably connected to the bad effect, we may conclude that the latter is used as a means to the good effect. The idea behind this test is that the presence of such an inevitable connection implies that the action and the bad effect merge into one another. Given that the action is necessarily a means to the good effect, the bad effect must, then, also be so. Note that the inevitable connection test is, for example, implicitly relied upon in the analysis of the craniotomy case. Here, crushing the foetus' skull (the action) is considered identical to the foetus being killed (the bad effect). For this reason, the foetus' death is taken to be a means to the good effect.
Is the action of intervening in the ageing process inevitably connected to the extended maximum lifespan ? It seems that it is not. In being (temporarily) relieved from ageing and its concomitants, one is not in any way protected against other potential causes of death, such as fatal non-ageing-related diseases, suicide, murder, etc. One may not reach the current maximum lifespan, despite having undergone treatment to decelerate or arrest ageing. Thus, according to the inevitable connection test, the extended maximum lifespan does not constitute a means to the good effect.

A second test simply consists in applying another definition of 'means', one which better approximates the common-sense understanding of the concept. Dan Brock [42], for example, offers such a definition: "The means are what an agent does because he believes them to be causally necessary or sufficient on the particular causal path taken to achieve his end" [42, p. 532]. The case for a prohibition against euthanasia and physician-assisted suicide under the DDE, for example, is built on an implicit use of this 'causal criterion'. The reason why a doctor performs such actions is the belief

that the patient's death (the bad effect) will be causally sufficient for relieving the patient's pain (the good effect), suggesting that the former is used as a means to the latter.

Contrary to the euthanasia/assisted suicide case, our case does not appear to satisfy the above definition of a means. It seems incorrect to say that the extended maximum lifespan (the bad effect) is either causally sufficient or necessary for obtaining the good effect (the postponement of age-related diseases). Rather, the opposite seems to be the case. As mentioned before, our current scientific knowledge suggests that the most promising way of obtaining an extended maximum lifespan is to tackle all age-related diseases simultaneously. This implies that the good effect is causally necessary[7] for obtaining an increased maximum lifespan, but not vice versa. In sum, the extended maximum lifespan represents the last stage in the causal chain and is, therefore, not a means to the good effect on the causal criterion test.

On both positions concerning the relationship between the second and third condition of the DDE, the increased maximum lifespan is not a means to the postponed onset of age-related diseases. Therefore, the third condition is met.

Condition 4: does the good effect outweigh the bad effect?

In order for an action to be justified by the DDE, the bad effect must not only be unintended as an end or as a means, the good effect must also be proportionate to the bad effect. Alan Donagan [43] explains the proportionality condition as follows:

> Whether or not the good effect is a proportionately serious reason is determined according to the principle that evil is to be avoided or prevented wherever possible, except at the cost of an equal or worse evil. If the nonoccurrence of the good effect would be as great an evil, or a worse evil, than the occurrence of the bad effect, then it is a proportionately serious reason for it. [43, p. 161]

Thus, we need to determine, from a deontological perspective, how the non-occurrence of the postponed onset of age-related diseases compares to the evil of an extended maximum lifespan. In order to make this assessment, we consider two scenarios, one in which interventions aimed at decelerating/arresting the ageing process are widely performed and one in which they are not. As we argue below, the outcome of the proportionality assessment differs in both scenarios. In this respect, the case at hand diverges from 'classical' applications of the DDE, where the frequency with which the actions are performed does not affect the outcome. For example, in the hysterectomy case, the

[7] That the good effect is not causally sufficient for obtaining an increased maximum lifespan follows from the fact that in decelerating/arresting the ageing process, one does not protect oneself against non-ageing-related causes of death.

good effect is considered proportionate to the bad effect, irrespective of whether such hysterectomies are performed on a small or large scale.

Let us start with the easiest scenario, where interventions in the ageing process are performed on a small scale. Consider first a (rather implausible) situation in which only one person in the world requests her ageing process to be decelerated/arrested. In granting the patient's request, the doctor ensures the postponed onset of all age-related diseases (the good effect). Since these diseases are responsible for (premature) death, the good effect brought about by the doctor's action may be redescribed as that of saving the patient's life.[8] Thus, the 'evil' that would be brought about by the doctor's omission can be interpreted as that of letting the patient die. The doctor thereby breaches her duty of rescue or beneficence. Given that interventions in the ageing process increase the number of healthy life years, continued life of a good quality is at stake here. It is, therefore, reasonable to assume that deontologists would consider the evil of letting the patient die much worse than that of the patient obtaining an extended lifespan. Thus, in the simple case, the good effect is likely proportionate to the bad effect.

Now suppose the number of patients requesting decelerated/arrested ageing is, although still relatively small, greater than one. In denying these patients' requests, the medical community is now letting *various* people die. Conversely, in granting these patients' requests, it causes *various* people to obtain an extended lifespan. However, there is no reason why this (numerical) difference with the simple case should change the proportionality verdict. On the contrary, given that more lives are at stake, the case for proportionality between the good and bad effect might be stronger still.

When advocates of decelerated/arrested ageing label these interventions morally permissible, they do *not* do so with the proviso that they be performed on a small scale only. Thus, proponents of these interventions are committed to defending interventions in the ageing process, irrespective of the scale on which these are performed. If they are to convince their opponents that the DDE can justify these interventions, then *both* the small and large scale performance of these interventions must satisfy the proportionality condition. As we have seen, the 'small scale scenario' passes the test. Below, we argue that this does not hold true for the 'large scale scenario'. Therefore, the fourth condition is not met.[9]

[8] de Grey [44] also characterizes the 'war on ageing' as a life-saving act. He states that in (indefinitely) postponing age-related diseases, "we are giving the beneficiary a greater remaining healthy potential lifespan than they would have if we held back, which is the beginning and end of what we mean when we say we have saved their lives […]" [44, p. 622].

[9] The high cost of interventions in ageing, one might object, makes it highly unlikely that these will be performed on a large scale. Therefore, one might argue, we should only take into account the small scale scenario and, thus, conclude that the proportionality condition *is* met. However, the *likelihood* of the large scale scenario is irrelevant to our analysis. After all, proponents of interventions in ageing argue that the DDE can justify *both* the small and large scale use of the latter. Therefore, if one of the scenarios (i.e. the large scale scenario) does not satisfy the proportionality condition, their argument no longer holds. The improbability of the large scale scenario does not change this.

Consider a scenario in which a significant part of the population requests an intervention in their ageing processes. Here, as is the case with the 'small scale scenario', omitting to bring about the good effect amounts to letting people die. The number of people that would die is much greater in the 'large scale scenario' than it is in the 'small scale scenario'. At first sight, then, the case for proportionality appears still stronger in the former scenario, relative to the latter. Nevertheless, a closer look at the bad effect in both scenarios compels us to revise this initial assessment. In the 'small scale scenario' the bad effect 'merely' amounts to a breach of the prohibition on an extended maximum lifespan. However, in the 'large scale scenario', the 'evil' inherent in the bad effect may go well beyond a breach of this single prohibition.

Many deontologists (see for example [45]) fear that there is a serious threat of overpopulation when faced with a large scale use of anti-ageing interventions. A marked increase in the world population could cause an array of adverse effects. Louria [46], for example, expects an increase in the number of large urban centres with slums, the unhygienic conditions of which would give rise to infections and epidemics. Other potential harms include: "increased poverty and malnutrition; resource depletion that, together with ethnic, religious, and tribal animosities, leads to ferocious conflicts; population-related global warming that, in turn, could create hundreds of millions of refugees and political instability that could lead to more strife" [46, p. 318].

Deontologists with these concerns could argue that in breaching the prohibition on an extended maximum lifespan, the medical community may also be breaching its duty not to inflict harm upon people. For these deontologists, the harm inflicted as a result of providing interventions in the ageing process will likely even amount to letting people die. After all, they view overpopulation as creating a situation in which people are inevitably deprived of basic needs for continued life. Ultimately then, they could reformulate the bad effect in terms of letting people die. Recall that the non-occurrence of the good effect also amounts to letting people die. From the perspective of the above deontologists, the proportionality condition will probably not be met in the 'large scale scenario'. First, in bringing about the bad effect we are breaching two prohibitions; we are both obtaining an extended maximum lifespan and letting people die. In refraining from intervening in the ageing process, on the other hand, we are merely breaching one prohibition. Second, population-related global warming and other harms attached to overpopulation may affect people worldwide. As Billings [47] argues, a harm affecting society generally carries more weight than one affecting merely an individual. Therefore, the globally felt effect of people dying likely constitutes too great an evil to justify interventions in the ageing process. The latter holds true, regardless of the magnitude of the good effect.[10]

[10] One might object that this verdict of non-proportionality is based on a problematic assumption, i.e. the conviction that overpopulation and its detrimental effects will occur. However, whether or not we will actually be confronted with overpopulation and its detrimental effects is irrelevant. We are merely interested here in

One might object that the reformulation of the bad effect in terms of harm to others is only obtained through an 'aggregative view', i.e. through considering the numerous interventions in the ageing process by many doctors *together*. More specifically, one might argue that on a 'piecemeal view', where every single intervention in the ageing process is considered separately, the bad effect merely amounts to one person obtaining an extended lifespan. Is the 'aggregative view' then the correct one to take? We think it is. Adopting the 'piecemeal view' in a context where one's action impacts not only upon the patient, but also on others, seems wrong. The 'piecemeal view' is oblivious to the potential effects of a large scale use of anti-ageing interventions on society at large. Parfit's 'Harmless Torturers' case [48] supports the use of the aggregative view in the 'large scale scenario'. In this hypothetical scenario, a thousand people each push a button that turns the dial of a torture machine one click. Whereas a single click causes imperceptible pain to the victim, the pain associated with a thousand clicks is excruciating. According to the 'piecemeal view', none of these torturers ever acts wrongly given that a single turn of the dial merely causes imperceptible pain. This conclusion is absurd. What matters is that, taken together, these torturers' acts inflict severe pain on the victim. Likewise, taken in aggregate, each doctor's intervention in the ageing process harms society at large.

CONCLUSION

Proponents and opponents of biogerontology have generally criticized each other's arguments from within their own moral frameworks. Recently, however, we observe a departure from this trend, with advocates of biogerontology seemingly appealing to arguments tailored to their opponents' normative theory. We have here examined one such argument, the 'double effect argument'. Although this argument deserves credit for breaking with a long-lasting tendency, it stands little chance of winning over its target audience, i.e. deontologists who consider the act of intervening in the ageing process impermissible. Our analysis suggests that deontologists may plausibly deem such interventions impermissible under the DDE. While it is plausible that interventions in the ageing process satisfy the second (the bad effect is unintended) and third (the bad effect is not a means to the good effect) conditions of the DDE, the first (the act is good or neutral) and fourth (the good effect outweighs the bad effect) conditions are problematic. Many deontologists may find the act of intervening in the ageing process not neutral or good in itself. Some may condemn it outright on the grounds that ageing is a normal process that should not be intervened in. Others may deem such acts morally good or neutral on condition that they constitute *natural* interventions in the ageing process. In any case, deontologists could plausibly argue that neither unnatural nor natural interventions satisfy the proportionality condition as both types of intervention involve an unacceptable trade-off between saving the lives of some (patients who undergo the interventions) and letting others die (those who

reconstructing the way in which deontological opponents of biogerontology may assess interventions in ageing against the standard of the DDE. From this perspective, all that matters is that there are deontologists who fear overpopulation and who, on this basis, would reject the idea of the proportionality condition being met.

suffer the consequences of large scale interventions in the ageing process). The assessment of the proportionality condition brings to light an important difference between the case discussed here and classical medical applications of the DDE. In these classical cases, the bad effect of the agent's act merely affects the patient (or the foetus, in cases where unborn life is at stake), never society at large. Therefore, the scale on which such 'classical' acts are executed does not impact upon the outcome of the proportionality assessment.

In this paper, we have tried to 'reconstruct' the way in which deontological opponents of biogerontology may assess interventions in ageing against the standard of the DDE. One might contest the soundness of our reconstruction, arguing that interventions in ageing are permissible under the DDE. However, even if the latter could be convincingly argued, it may not further the cause much of those appealing to the 'double effect argument'. Presumably, the whole point of winning over deontological opponents consists in securing the much needed (public) funding for biogerontological research. Therefore, an argument is needed which provides these opponents with an incentive to act in a way which enables the development of interventions in ageing. However, the incentive provided by the DDE is not as strong as it could be, given that the DDE merely confers a permission to act, not an obligation.

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