Space travel does not constitute a condition of moral exceptionality. That which obtains in space obtains also on Earth!

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ABSTRACT

There is a growing body of scholarship that is addressing the ethics, in particular, the bioethics of space travel and colonisation. Naturally, a variety of perspectives concerning the ethical issues and moral permissibility of different technological strategies for confronting the rigours of space travel and colonisation have emerged in the debate. Approaches ranging from genetically enhancing human astronauts to modifying the environments of planets to make them hospitable have been proposed as methods. This paper takes a look at a critique of human bioenhancement proposed by Mirko Garasic who argues that the bioenhancement of human astronauts is not only functional but necessary and thus morally permissible. However, he further claims that the bioethical arguments proposed for the context of space do not apply to the context of Earth. This paper forwards three arguments for how Garasic's views are philosophically dubious: (1) when he examines our responsibility towards future generations he refers to a moral principle (which we will call the *principle of mere survival*) which, besides being vague, is not morally acceptable; (2) the idea that human bioenhancement is not natural is not only debatable but morally irrelevant; and (3) it is not true that the situations that may arise in space travel cannot occur on Earth. We conclude that not only is the (bio)enhancement of humans on Earth permissible but perhaps even necessary in certain circumstances.

RIASSUNTO

Oggi si discute sempre più sulle questioni etiche e, in particolare, bioetiche dei viaggi e della colonizzazione dello spazio. È ovvio che nel dibattito si può trovare un'ampia varietà di prospettive relative alle questioni etiche e all'accettabilità morale delle diverse possibilità tecnologiche impiegabili per affrontare le difficoltà dei viaggi nello spazio. Le soluzioni morali che sono state proposte coprono un ampio ventaglio di interventi: dal potenziare gli astronauti umani attraverso interventi di modificazione genetica al modificare gli ambienti dei pianteti per renderli più ospitali. Questo articolo si confronta con le posizioni espresse recentemente su quest'argomento da Mirko Daniel Garasic: egli sostiene che il biopotenziamento degli astronauti è moralmente accettabile perché non soltanto è funzionale, ma necessario e che, tuttavia, questa conclusione vale per i viaggi nello spazio ma non si applica alla Terra. Questo articolo intende mostrare che la posizione di Garasic non è filosoficamente convincente attraverso tre argomenti: quando esamina la nostra responsabilità nei confronti delle generazioni future egli fa riferimento ad un principio morale (che noi chiameremo della mera sopravvivenza) che, oltre ad essere vago, non è moralmente accettabile; l'idea che il biopotenziamento umano non sia naturale non soltanto è discutibile, ma moralmente irrilevante; non è vero che le situazioni che possono presentarsi nei viaggi nello spazio non si possono presentare sulla Terra. La nostra conclusione è che il biopotenziamento degli esseri umani sulla terra attraverso interventi di modificazione genetica non soltanto è consentito, ma in determinate circostanze potrebbe essere anche moralmente necessario.

Key words: bioenhacement, Mars, Earth.

Parole-chiave: biopotenziamento, Marte, Terra.

« Since, in the long run, every planetary civilisation will be endangered by impacts from space, every surviving civilisation is obliged to become spacefaring--not because of exploratory or romantic zeal, but for the most practical reason imaginable: staying alive... If our long-term survival is at stake, we have a basic responsibility to our species to venture to other worlds» [1]

Carl Sagan

1. Introduction

Mirko Garasic's thesis is that we can ground the moral acceptability of human enhancement interventions in the case of expeditions to another planet (or the conquest of space). However, this does not give us a reason to consider such enhancements as being morally acceptable on Earth [2]. More specifically, he argues that we currently do not have a moral justification for resorting to the enhancement and modification (or rather improvement) of either the cognitive and/or physical characteristics of our children. The reasons that, according to Garasic, do not allow us to extend the (moral) justifications for the enhancement that apply to space expeditions to the situation here on Earth is that in the first case, the enhancement intervention would not be a real enhancement but rather a therapy, as it would allow the people concerned to live (or survive) in a hostile climate. On the other hand, enhancement on Earth would not have this purpose, as we would not have any need for enhancement interventions to survive and, for this reason, they would not be therapeutic. We have abundant literature on human enhancement that discusses the possibility of distinguishing between enhancement interventions and interventions with only therapeutic purposes.

John Harris and Julian Savulescu have convincingly explained why any attempt to make a distinction between enhancement and therapeutic interventions not only fails specifically but also fail to represent the starting point for any serious moral reflection [3, 4]. We can begin by saying, at the very least, that if we consider the individual (affected by the intervention), any therapeutic intervention is *de facto* an improvement intervention (as it improves their previous condition). We can take vaccines as an example; they are a therapeutic intervention that makes this fact remarkably clear. Furthermore, an enhancement intervention could be as therapeutic as any other medical treatment given that it could ameliorate the psychophysical wellbeing of the subject. This means that even if, then, we wanted to try to distinguish between therapeutic and enhancement interventions, it would be difficult to morally approve the former (the therapeutic ones) but reject the latter, as both aim to render, through interventions on their host, the people better able to interact with other people and with their environment. Garasic, on the other hand, intends to argue that the distinction between therapeutic and enhancement interventions remains valid. Still, it must be acknowledged that space travel opens up new scenarios and that enhancement interventions on Earth would become merely therapeutic ones in space. According to him, this has important repercussions on a 'regulatory' level. Once we consider the scenarios that yesterday seemed like science fiction and concern space travel, we can say that these scenarios represent (and justify) a condition of moral exceptionality. More specifically, he argues that there are interventions that are morally acceptable for space travel that we cannot accept on Earth. In this paper, we aim to show that space travel does not represent any condition of moral exceptionality. On the contrary, it contributes to reasoning about the acceptability of any form of enhancement regardless of spatial context.

2. The *Principle of Mere Survival* is not an adequate principle for reproductive choices.

According to Garasic, at least as long as one lives on Earth, specific characteristics of the human species should never be changed because they are natural (that is, they are the result of evolution) and are sufficient to ensure people, or at least most of them, survival. If the goal is to conquer space, bioenhancement cannot be refused. With our current biological makeup, he argues that we could not have any hope of surviving a long journey in space or on a colony on Mars or the Moon. The problem - says Garasic - is that space (or another planet) would be a hostile environment for any human being or to any human colony due to cosmic radiation and other geological, environmental, or atmospheric hazards. The point is that the founding of a new colony in such a hostile environment (on Mars or anywhere else) would put to the test even the most daring conqueror (or human being), who, finding themselves in this new condition, would feel isolated, depressed, bored, and in dire need of social interaction. It is for this reason that he argues that (bio)enhancement (i.e., psychological, cognitive, and physical enhancement) is necessary (and morally justified) for any mission in space and/or on another planet. On Earth, however, one can survive without enhancement, i.e., without interventions that modify our cognitive or physical abilities.

Consequently, Garasic concludes that we do not need to change the characteristics (or capacities) present in the human species on Earth. He goes even further to say that doing so would be a serious moral error, as accepting the (bio)enhancement for space travel does not oblige us to accept it for life on Earth as well saying that "any attempt to create a back-and-forth continuum is misleading and a *non sequitur*. Mars and Earth are not only different planets, but they are also different worlds" [2, p. 326].

Despite the fact that it is beyond evident that we are not immortal, and we can get sick, our innate characteristics nonetheless allow us to survive for a finite number of years and equip us to deal with many difficulties and to look at the world with optimism without letting ourselves be intimidated or paralysed by those concerns. On the other hand, a person on Mars would have no chance of surviving or - even if they managed to survive - would not be able to endure their existence for a long time and would try to kill themselves. For this reason, Garasic concludes that (bio)enhancement is a necessary intervention. On Earth, however, these problems do not exist. We can live in a welcoming environment, or at least not in a life-threatening and hostile one. This makes a life worth living at least not environmentally difficult, and, it is for this reason, that Garasic says that any form of (bio)enhancement would be wrong.

Garasic's analysis allows us to reason and confront the theme of (bio)enhancement authentically, but with results that are particularly problematic if we consider them from the perspective of the most recent bioethics debate. In recent years, the bioethics scholarship has shown the need to identify the principles (or the theoretical moral perspective) that should guide people who want to have a child at the time on how to ethically employ reproductive technologies that permit us not only to prevent genetic anomalies but also to enhance the genetic heritage of the child. The bioethics debate has been divided between those who defend an impersonal (and maximising) perspective and those who adopt a personal (or "personal impact") perspective, the latter of which supports the position that choices must be made by evaluating the consequences for the individuals involved [5]. Those who look at things from an impersonal perspective say that people who want a child have a moral duty to bring the child into the world who, given their genetic endowment, we may think will be more likely to have the best life. On the other hand, those who defend a perspective of "personal impact" argue that (in any case) the

most important thing is that the child who is born has, at least, a life worth living. Further, this position holds that a parent is morally praiseworthy if they ensure that their children have a better life. However, we shouldn't criticize them if they don't, given that the life of the child remains worth living because it is good in itself to the child that they were born in the first place.

In *Il Bambino Migliore?* (2022), Balistreri argues that while an impersonal maximising principle appears too demanding, the *minimum threshold principle* expects too little from parents [6]. Balistreri argues, citing Glover [7, p. 52], that something is disturbing in a principle that states that we do nothing wrong even if the child we bring into the world will live in a condition of great suffering and renunciation, *at least as long as their life is still worth living*. This is not the best way to think about the principle or the best moral perspective, that is, the one that should guide parents' choices about whom to bring to the world. What we want to do is simply draw attention to the fact that in Garasic's analysis, he seems to suggest to parents a principle (of choice) that had never before been proposed (or considered). The principle (of choice) that Garasic offers is not attributable to an (impersonal) principle of charity. This is because it does not prescribe maximising the wellbeing of the people who will be born or bringing the happiest people into the world. Likewise, neither is it even a principle that requires parents to ensure that the children they bring into the world have a minimum threshold of wellbeing. He argues that in light of new (reproductive) technologies that allow for the control of the genetic heritage of born people, *a responsible parent should not have their children born in a better condition than that which allows mere survival*. This is the philosophically interesting point; Garasic does not seem to leave room for incorrect or questionable interpretations: we must enhance the genetic code of the people who will live on Mars because otherwise, these people could have no hope of survival. When survival is not at stake, however, we should never resort to enhancement, even if (bio)enhancement were a safe technology (i.e., there is no, or at least minimal risk of unwanted consequences) and could ensure that people are born with a better quality of life.

However, Garasic's *principle of mere survival* appears questionable for several reasons. First of all, it justifies a progressive worsening of the quality of life of future generations, as it is difficult to establish a precise limit (to the further deterioration of conditions), beyond which people could no longer survive or would no longer have a worthy life. However, we know how to adapt to changing and challenging circumstances and reshape our desires and needs based on those conditions, but we also continue to do so with the hope of a better life in the future. Furthermore, our ability to concentrate more on positive aspects than negative ones can help us endure situations that would otherwise appear difficult or impossible to endure [8]. Secondly, *it is not clear why we should morally criticise a parent who believes that they have a responsibility to assure that their children not only have a life per se but one that goes beyond mere survival, a more promising lif*e. It is not fair to expect a parent to sacrifice everything for the benefit of their children, but a parent who chooses to work to improve the lives of their children still seems commendable. It is impossible, then, not to assure those we bring into the world a (condition of) life superior to mere survival, given that anything we do to improve our condition could indirectly improve the situation (of life) of future generations as well. For example, advances in medical research promote our well-being and have a good quality of life even in our later years. Still, our children will be the beneficiaries of these advances' even more profound benefits.

3. It is not true that (bio)enhancement in space would be natural or more natural than bioenhancement on Earth

According to Garasic, people who venture into space will be aware that they will encounter a hostile environment in their mission and consequently may require or accept genetic modification interventions to have a better chance of surviving in seemingly uninhabitable conditions. In this case, it would not be an ameliorative intervention but merely a therapeutic one. Garasic states that: "If a certain genetic modification is necessary on Mars to survive, that makes it therapy - and given the unique health threats that Space might represent, not providing them would imply lower standards of care, and that seems unacceptable. Yet, it is equally important to understand that, again, the switch from enhancement to therapy would apply in that context and does not follow that once we will see a modification legitimate on Mars, we will have to accept as equally legitimate the same (or other) enhancement (s) on our planet " [2, p. 324]. Without (bio)enhancement interventions, both physical and cognitive says Garasic, we would not have the ability to live/survive in space for an extended period, and, as a consequence, we could become a continuous threat to the life of other people and of our community [2, p. 326]. On Earth, however, there would be no such problems.

Consequently, using new technologies, particularly genome editing, would not be morally acceptable because it would change - perhaps irreversibly - the characteristics of our species. Garasic affirms that any intervention of (bio)enhancement would not be natural (at least if practised on our planet and not, for example, for missions in space or on Mars). In these cases, it would still be a matter of a “passively natural” intervention, because, in any case, and Garasic seems to affirm, in space, the genetic code would undergo modifications.

It is now, however, an established point of bioethical reflection (and, more generally, of moral philosophy) that establishing "what is natural" and "what is not" is a complex philosophical question. Even knowing what is natural does not aid us in knowing what is moral, given that what is natural can be harmful and what is not natural can be good. However, Garasic says that the (bio)enhancement of people engaged in space exploration would be (or could be considered) natural because, in any case, prolonged exposure in an extraterrestrial environment would produce significant genetic changes anyway. However, it is legitimate to ask whether these changes would be the same as those that we might be interested in producing in people through targeted interventions on their genetic heritage; those who think that the result would be different are probably not far from the truth. Moreover, one of the advantages of (bio)enhancement interventions would be precisely that of preventing or protecting against genetic modifications produced by radiation.

Furthermore, while (bio)enhancement would improve not only the physical but also the cognitive abilities of the people concerned, living in an extra-terrestrial environment could, in the long run, have devastating consequences on subjective capacities and dispositions. However, if we consider things from this perspective, (bio)enhancement interventions on Earth would be no less natural than interventions feasible in space. Even on our planet, the genetic heritage will still be subject to substantial changes.

The process would probably be much slower, but the result would ultimately be the same; that is, there would be a significant change in the genetic makeup of the human population. Apart from these considerations, we could always ask ourselves why we could not (or even should) consider natural genetic modification interventions produced starting from the knowledge acquired over time through the accumulation of our experiences. Is it not natural to improve one's skills and treasure one's experiences? Furthermore, to argue that modifying the genetic makeup of humans would not be natural, Garasic must assume that humans have never had very different DNA from that we possess today, nor DNA similar to what we might have if one day we choose to modify their DNA. We refer to things that we believe are evident to all in any moral consideration. For example, we

could not criticise the mistreatment of animals in (intensive) farms if it were not possible to refer to facts (the farms, the mistreatment, the suffering of the animals concerned, the behaviour of the farmers) that others can accept. However, Garasic does not ask the reader to share ordinary and easily observable facts, but a particular theory on the origin of human life on Earth - as an indigenous species - that we can also share and that some people may not accept. Some people, for example, believe that (human) life on Earth has an extraterrestrial origin; that it was brought to our planet from other galaxies a long time ago.

On the other hand, "Ancient astronauts" (or "ancient aliens") refer to a hypothesis held by people who believe that extraterrestrial civilisations have had contacts and perhaps even forms of 'hybridisation' with ancient human civilisations. These people might think that once human beings had completely different characteristics that they then later lost by adapting to life on Earth. For them, (bio)enhancement could be the only way to return to their original characteristics. We do not want to suggest that the ancient astronaut theories have any plausibility or are based on scientific evidence; on the contrary, we think they have no scientific value and are mere collective fantasies. However, it is interesting to note that a proponent of an ancient astronauts hypothesis would probably have no difficulty in accepting most of our moral beliefs; such as, for example, that suffering is something terrible, or that people should be respected and not mistreated, but they may have difficulty accepting Garasic's moral conclusions about enhancement. His moral position on enhancement is demanding from an epistemic point of view; it can only be accepted by those who share his ideas or theories on the origin of human life. That is, his arguments on the unacceptability of bioenhancement may appear less convincing or incapable of proving that bioenhancement is always wrong if one does not accept his theory on the origin of life or subscribe to some other idea.

Finally, Garasic seems to think it is possible to distinguish what we do in space clearly, or the colonisation of other planets, from what we do on our planet. However, it is difficult to imagine that (bio)enhancement interventions practised in space (or on Mars) will not have essential consequences on life on Earth and our terrestrial community. People who leave for space missions or the colonisation of Mars, after a certain number of years or missions, may have a desire to return to Earth, or the people who are (bio)enhanced and leave for space may simply, at the last moment, change their mind, have an accident, or suddenly suffer from some pathology that would result in them remaining on Earth. We could, then, also imagine that people who leave for space undergo genetic changes that make it difficult or impossible for them (and their descendants) to readjust (to live) on Earth, but perhaps this would be morally unacceptable. It is not difficult to think that on a colony on another planet (for example, Mars), children could be born and that these and their descendants could look at the Earth with curiosity and interest and have the desire to one day return to the planet where they originate. It could be argued that these people should have the right to return home: "There is no doubt that every human being born in a future space colony should have the right to make the decision to return to Earth, and previous generations without their knowledge and consent cannot establish irreversible obstacles to this. (…) If the conditions listed in the section above are met, the right to re-adaptation, and the possible prevention of it by the modifications introduced, is a severe moral challenge. Perhaps it is even the type of obstacle that should preclude the possibility of such missions until the difficulty of re-adaptation to Earthly conditions is eliminated [9, p. 4].

Furthermore, we should always consider that someone might want to speculate on these (bio)enhancement interventions and, once they have acquired the necessary expertise, offer them to any Terran willing to pay handsomely in exchange for (bio)enhancement. But we can also imagine other scenarios. For example,

some people may simply have the desire to self-empower themselves (and their offspring) through genome editing, and we may not have the tools to stop them from doing so. This means that in the long term, if we don't allow, or at least justify, (bio)enhancement interventions on human beings who remain on Earth, it could exacerbate injustices, as an increasingly enhanced species could live alongside a 'natural' human species. Szocik et al. [9] affirm that, in any case, enhancement interventions would only have a therapeutic function, in the sense that they should simply serve to allow life in space and should therefore not concern intelligence or morality, as has been proposed in the debate on (bio)enhancement, but simply health.

For this reason, according to Szocik et al. [9], We should not worry that any relationships or contacts between enhanced and non-enhanced people could produce situations of injustice. However, they concede that (bio)enhancement interventions should enable people to have better abilities than their natural counterparts, such as better eyesight to recognise objects or radiation in the dark or dust storms. Garasic, then, is right when he says that for crews on missions in space or on other planets (bio) cognitive enhancement may be necessary to deal with the conditions of loneliness and the risks associated with the difficulty of adapting to a wholly new and hostile environment. Interventions of this kind allow people to develop better dispositions and skills.

4. Space travel does not represent (or justify) any condition of exceptionality

Even if we could exclude a return of people born with 'enhanced' dispositions on Earth, there could still be conditions that threaten the survival of the human species and consequently justify an enhancement intervention. Garasic himself recalls that some authors have argued that genetic modification (or "moral" enhancement) interventions could become necessary to prevent disastrous consequences for all humanity or to reduce our impact on ecological balances. It does not seem appropriate, therefore, - and it may seem that Garasic himself recognises this - to take a principled position against any improvement intervention on Earth, as we cannot exclude that they may one day be necessary, and therefore, justified. That is to say, enhancement interventions may also seem morally inappropriate today, but it could be wrong to rely on this conclusion for any conceivable scenario, since, for example, due to a progressive worsening of environmental conditions or the spread of a lethal virus, our living conditions could change radically. Garasic indeed excludes that there may be situations that justify the upgrade. In his opinion, even in a position that puts our survival at risk, we could always imagine solutions that are morally more acceptable than empowerment.

Imagine, for example, Garasic says, a severe ecological crisis; instead of shrinking human beings or modifying them to make them more empathetic with future generations, we could force people to die at a certain age or ban them from having children. By doing so, we would deprive people of important spaces of autonomy (and freedom of choice), but at least we would not force them to undergo interventions that put their humanity at risk. Garasic argues that "all these ideas might be seen as extreme (and they certainly are from a certain point of view), but they seem to be less threatening of the existential condition of humanity. We might have restrictions on our liberty and choices, but - this is Garasic's conclusion - we will not be exposed to a structural change of what it means to be human "[2, p. 325]. However, Garasic is inconsistent in that when he considers (the people who live on) the Earth, he defends the obligation to preserve human nature from any change (or enhancement) even at the cost of imposing on the people concerned significant sacrifices or limitations of their freedom (or autonomy).

On the other hand, he considers missions in space or the conquest of Mars; he believes that any enhancement intervention - capable of increasing the survival chances of the crew and, consequently, the success of the mission - is (morally) permissible. Suppose human nature (or the existential condition of humanity) is such a fundamental good, which we must preserve, regardless of the benefits we may obtain. In that case, it should support the conclusion that space exploration does not deserve the minimum effort. If, on the other hand, he thinks that one should not take a principled position against enhancement but evaluate things taking into account the risks and the possible benefits,[1] he would have to admit that (bio)enhancement could also be justified on Earth. *In no case, however, does Garasic's article achieve its objective, nor does it manage to show that even if some states of moral, political, and legal exceptionality could be tolerated in space that the same exception should or can be implemented on Earth* saying that "this paper wants to introduce to a wider audience the concern that it is of crucial importance to acknowledge that the exceptionality of the conditions occurring in space should not be used as a tool to lower our guard towards a mass implementation of societal, biological and ethical revolutions on this planet and our world as the result of maladapting states of exceptionality that might work well in space but have a much weaker ethical legitimacy on Earth" [2, p. 317]. Space travel does not represent (or justify) any condition of moral exceptionality, and there is no reason to think that what is valid for space travel cannot be valid for the Earth.

On the other hand, if we consider things more carefully, the conditions on Earth could justify human (bio)enhancement more than any trip or mission in space. If environmental conditions worsen and we continue to be indifferent to the wellbeing of future generations, reprogramming the genetic heritage of people who are born could be the right choice or, in any case, an option to be considered together with the others. There could be other solutions, but genome editing could prove to be a more straightforward and more effective one, and it would be a solution that, unlike what Garasic suggests, would not require (perhaps intolerable) restrictions of our freedoms and our reproductive autonomy [10]. It does not make sense, however, to state that (bio)enhancement in space is necessary because otherwise, no crew, even the most capable one, would not have the ability to survive for long, as there is a more straightforward solution to these problems: not to go on the mission in the first place. It is true that in space travel or the colonisation of Mars, people will find themselves in environmental conditions that will put their health at risk (radiation and low/zero gravity). But it would be improper to call this condition a state of necessity, as space missions (or those for the colonisation of Mars) are voluntary. They are the result of choices. Undergirding a mission may be a series of political decisions and national interests. Consequently, barring reasons to the contrary, such tasks could be cancelled or postponed until we have the technology that allows safe travel.

Another solution could be to provide only completely 'automated' missions. In doing so, we should not give up the advantages of space exploration. Garasic seems to think that on our planet, enhancement is never the only solution; any problem, that is, could be faced without the need to change human nature, while for space, it would be difficult (if not impossible) to imagine (possible) alternatives.

However, this is not true, as scientific and technological development could allow us, for example, to tackle the problems related to radiation and weightlessness through the use of (external) technologies that protect (from radiation) or make increase severity. At the moment, it is difficult to think that these can be genuinely effective and definitive solutions to undertake any space travel or colonisation

[1] Garasic does not dwell much on the benefits of space travel, but seems to take them for granted.

mission of other planets. Still, things in the near future could change, and new scenarios could open up, which could help strengthen the crews without the need to modify their genetic heritage. Furthermore, the growth of the global population and consequential energy consumption requirements, as well as other threats coming from other planets or the sun, could make the Earth, as Stephen Hawking suggested, more and more inhospitable and therefore make migration to other planets our only viable chance of survival [11]. In this case, if the (bio)enhancement is necessary for space travel, it would no longer concern only a tiny number of people who make up the crew of the mission, but the entire human population who, before leaving, will have to acquire new skills and dispositions.

In any case, the distinction between conditions on Earth and conditions in space appears arbitrary not only at the normative level, that is, when considering the moral acceptability of enhancement (the double standard), but also on the descriptive level. The question is not only, as Francesca Ferrando [12] recalls, that (extra-terrestrial) space has always been a point of reference and also a normative model for human beings; the fact is that there is no solution of continuity between our planet and what goes beyond. The borders (that is, the walls), that is, are always conventional and can always be moved.

5. Conclusions

Although space colonisation remains a future endeavour, there are serious questions regarding how to undertake such an enterprise successfully. Various scholarly debates have emerged as to the ethical issues associated with space travel and colonisation, among which is the (bio)ethics of human enhancement to survive the rigours of space travel and living. This paper took the argument proposed by Mirko Garasic [2], who argued that not only is human enhancement useful for space travel and colonisation, but it is necessary. Furthermore, Garasic contends that the argument for why such enhancements are morally necessary, and thus permissible, for space travel and colonisation does not necessarily mean that the same view grounds the moral permissibility of (bio)enhancement on Earth. This paper proposed three main arguments for why Garasic's thesis is philosophically dubious. Further philosophical research can explore the (bio)ethical permissibility of enhancement interventions for various contexts of use in space ethics and how to weigh the ethics of choosing (bio)enhancement interventions for extraterrestrial colonisation in comparison to geoengineering and terraforming interventions instead.

References

[1] Sagan, Carl. *Pale blue dot: A vision of the human future in space*. Random House Digital, Inc., 1997.

[2] Garasic, Mirko Daniel. "The war of ethical worlds: why an acceptance of Posthumanism on Mars does not imply a follow up on Earth." *Medicina e Morale* 70, no. 3 (2021): 317-327.

[3] Savulescu, Julian. "Genetic interventions and the ethics of enhancement of human beings." *Readings in the Philosophy of Technology* (2009): 417-430.

[4] Harris, John. "Moral enhancement and freedom." *Bioethics* 25, no. 2 (2011): 102-111; Harris, John. *Enhancing Evolution: The Ethical Case for Making Better People*. Princeton (NJ): Princeton UP, 2010.

[5] Magni, Sergio Filippo. "In Defence of Person-Affecting Procreative Beneficence." *Bioethics* 35, no. 5 (2021): 473-479.

[6] Balistreri, Maurizio. *Il bambino migliore? Che cosa significa essere genitori responsabili al tempo del genome editing*. Roma: Fandango, 2022.

[7] Glover, Jonathan. *Choosing Children: Genes, Disability and Design*. Oxford: Oxford UP, 2006.

[8] Benatar, David. *Better Never to Have Been: The Harm of Coming Into Existence*. Oxford: Oxford UP, 2006.

[9] Szocik, Konrad, Mark Shelhamer, Martin Braddock, Francis A. Cucinotta, Chris Impey, Pete Worden, Ted Peters et al. "Future space missions and human enhancement: Medical and ethical challenges." *Futures* 133 (2021): 102819.

[10] Sorgner, Stephan Lorenz. *We Have Always Been Cyborgs: Digital Data, Gene Technologies, and an Ethics of Transhumanism*. Bristol: Bristol UP, 2021.

[11] Cooper, Gael Fashingbauer. "Stephen Hawking: Earth Could Be 'Ball of Fire' in 600 Year". https://www.cnet.com/news/stephen-hawking-earth-ball-of-fire-600-years-tencent-we-summit-beijing/

[12] Ferrando, Francesca. "Why Space Migration Must Be Posthuman". In *The Ethics of Space*, edited by James S.J. Schwartz, Tony Milligan, 137-152. Springer: New York, 2016.