The Ethics of Outer Space: A Consequentialist Perspective

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Abstract
Outer space is of major interest to consequentialist ethics for two basic reasons. First, the vast expanses of outer space offer opportunities for achieving vastly more good or bad consequences than can be achieved on Earth alone. If consequences are valued equally regardless of *where* they occur then achieving good consequences in space is of paramount importance. For human civilization, this can mean the building of space colonies or even the macroengineering of structures like Dyson swarms. However, as a practical matter for contemporary decision making, there should be *less* effort towards space colonization and *more* effort towards preventing civilization-ending catastrophes. Preventing the latter will ensure that future generations of humans will then have the opportunity to colonize space. The second reason why space should be seen as having a major importance for consequentialist ethics is the possibility that humanity may encounter an intelligent extraterrestrial civilization. This possibility poses difficult questions concerning which consequences should be pursued, given that any extraterrestrials who are in a position to make contact with us are also likely to be significantly more advanced than humanity. If they are indeed more advanced, then better consequences might accrue if humanity defers or even commits some form of civilizational suicide in order to make more space for their expansion. This possibility may also lead humans to rethink our own relation to less advanced other species on Earth.

Keywords: consequentialism; ethics; extraterrestrials; outer space; space colonization

1. Introduction

Consequentialism maintains that individuals should act so as to achieve good consequences. It is typically, but not necessarily, structured as an exercise in optimization: individuals should act so as to achieve the best consequences that they are able to bring about. Consequentialism is one of the most prominent and widely supported forms of ethics, though it is also often criticized (e.g., Scheffler 1982; 1988; Glover 1990). In this paper I will discuss the significance of outer space for a range of consequentialist views.

Most treatments of consequentialism focus on consequences located on Earth. When people ask, "What are the consequences of my actions?", they usually do not consider the consequences for other planets or faraway stars or galaxies. Research using consequentialist frameworks has a similar terrestrial focus. This holds even for big-picture consequentialist research like cost-benefit analyses of climate change actions, which consider consequences for the entirety of Earth and many years into the future but nothing beyond Earth (e.g., Stern 2006; Nordhaus 2007). This terrestrial focus may seem reasonable, but it is a mistake.

Outer space is important for consequentialism for at least two reasons. First, the vast expanses of outer space offer opportunities for achieving vastly more good or bad consequences

than can be achieved on Earth alone. Actions that bring good consequences to some significant portion of the universe are of exceptionally high value in many consequentialist frameworks.

The second reason why outer space is important for consequentialism is the possibility that humanity may encounter an intelligent extraterrestrial civilization (abbreviated ETI for extraterrestrial intelligence). Conspiracy theories aside, no such civilization has yet been detected. It is possible that none exist. However, the search for extraterrestrial intelligence (SETI) remains a young endeavor. As it proceeds, and as humanity progresses and expands as a civilization, the odds of an encounter increase. ETI encounter poses certain challenges for consequentialism and can also yield some dramatic consequences.

This paper contributes to a modest body of prior literature on outer space consequentialism. For example, the vast opportunity for human colonization of outer space to bring is discussed in Ng (1991), Tonn (1999; 2002), Ćirković (2002), Bostrom (2003), and Baum (2009; 2010a). Additionally, Rolston (1986), Fogg (2000), Cockell (2005), Haqq-Misra (2012), and Milligan (2015) consider whether space colonization would be a good consequence. Finally, Cockell (2007), Baum (2010b), and Baum et al. (2011) discuss the ethics of ETI encounter. These publications do not all endorse consequentialism or focus exclusively on consequentialism but nonetheless contain relevant discussion.

2. Consequentialism Specifics

There are many different consequentialist ethical frameworks, with varying implications for outer space. This section presents some different consequentialist frameworks in terms of what they intrinsically value and how the intrinsic value is weighted across species and spatiotemporal location. Sections 3 and 4 then discuss implications of the different consequentialist frameworks for outer space. This section also briefly argues for my preferred form of consequentialism. My arguments are likely too brief to be widely convincing and are intended simply to let the reader know where I stand.

Before diving into the specifics, here is a brief defense of consequentialism. This is also not intended to be widely convincing, only to hint at consequentialism's appeal. The appeal is that consequentialism recommends whatever is best for the world or the universe, however "best" is defined (more on that below). Some critics argue that certain actions are required or forbidden regardless of the consequences. But suppose, for example, that torturing someone would somehow spare many other people from torture. However deplorable torture may be, it should not be categorically forbidden, nor should anything else. Other critics argue that at least some circumstances cannot be resolved by evaluation of consequences, and instead must be resolved through use of "practical wisdom" or virtue. But then one could claim, for example, that refusing to torture someone is virtuous, again even if it results in many other people being tortured. Appeals to virtue do not excuse causing worse outcomes. In short, consequentialism succeeds by considering all of the possible outcomes of all of the possible options and recommending whichever option is best.

2.1 Intrinsic Value

Something is intrinsically valuable if it is valuable for its own sake (Rønnow-Rasmussen and Zimmerman 2005). In contrast, something is extrinsically valuable if of its value derives from its relation to intrinsic value (Bradley 1998). The most commonly discussed type of extrinsic value is instrumental value, which is valuable because it causes intrinsic value. For example, if human health holds intrinsic value, then medicine can hold instrumental value.

Consequentialism ultimately seeks to increase intrinsic value. A consequentialist may pay attention to extrinsic value, but this is only because it affects intrinsic value. Intrinsic value is so central to consequentialism that specific frameworks are often known in terms of what they consider to hold intrinsic value. Here are some important examples:

- *Subjective experience* is the cognitive sensation had by sentient beings, essentially how something is perceived to feel. A consequentialist framework that intrinsically values subjective experience essentially says "if it feels good, it is good". This is one form of utilitarianism (e.g., Tännsjö 1998; Ng 2003). Other terms used for subjective experience include welfare, wellbeing, and quality of life. The feeling of subjective experience need not be a crude, instantaneous pleasure; instead, it can be a more complex overall life experience. Indeed, for some people, periods of adversity are found to bring overall life benefits (Seligman 2010).
- *Preference satisfaction* occurs when individuals get what they want. It is distinct from, but often conflated with, subjective experience. The two differ in that individuals do not necessarily prefer improvements in their own subjective experience. Preference satisfaction holds intrinsic value in the other major form of utilitarianism (e.g., Barry 1989; Adler and Posner 2000). It also underlies some consequentialist forms of procedural justice, such as voting schemes for making social choices, on the premise that people vote for what they prefer.
- *Ecosystem flourishing* occurs when ecosystems are healthy and productive and biologically successful. A single biological organism would have a small amount of ecosystem flourishing on its own; an intricate community of organisms would have more. Ecosystem flourishing is used often in wildlife management (Niemi and McDonald 2004), and some argue that it should be the basis for all ethics (Holbrook 1997). Consequentialist ecocentrism places intrinsic value on ecosystem flourishing and argues that individuals should act to increase it.
- *Abiotic systems* contain no life. In this context, abiotic systems are usually understood to also contain no sentience or intelligence, meaning that they exclude abiotic artificial intelligence (AI). The intrinsic value of abiotic systems is especially important for extraterrestrial settings because they are not known to contain any life. An important form of abiotic consequentialism holds that intrinsic value is diminished when life or AI intrudes on an undisturbed abiotic system (Rolston 1986; note that Rolston does not discuss AI but the same logic applies to both AI and life).

A particular consequentialist framework can place intrinsic value on several or all of these phenomena, and/or other phenomena as well (Baum 2012). For example, Milligan (2015) proposes that abiotic or microbial extraterrestrial environments should be colonized by humans only if humans had sufficient reason to do so. While Milligan (2015) avoids purely consequentialist reasoning, the logic nonetheless parallels what a consequentialist framework might recommend if it intrinsically values humans as well as abiotic or microbial extraterrestrial environments.

I would argue for placing intrinsic value exclusively on subjective experience. The simple reason is that only subjective experience feels good. The good feelings we experience give us reason to be glad we exist, and likewise give us reason to be glad for the existence of other beings that have positive subjective experiences. Ecosystems and abiotic systems might seem nice to us, but they cannot enjoy their own existence. Their existence brings them no joy or happiness or any other subjective experience, without which they have (I would argue) no reason

to be intrinsically valued. The argument against preference satisfaction is subtler and not crucial for this paper.

2.2 Species

Should intrinsic value be weighted equally across all species? For example, is the subjective experience of a chicken worth as much as that of a human? Most treatments of consequentialism only place intrinsic value on humans, i.e. their ethics are *anthropocentric*. Some count all intrinsic value equally regardless of species; Baum (2010b) calls this *universalist*, but in this paper I will use the term *egalitarian* because its core feature is the equal weighting of intrinsic value. A fully egalitarian framework must also weight equally across location (Section 2.3). I will use the terms *species-egalitarian* and *location-egalitarian* for frameworks that are egalitarian with respect to species and location, and the unqualified term *egalitarian* for frameworks that are egalitarian with respect to both.

I would argue for species-egalitarianism. It is an arbitrary coincidence which species anyone happened to be born into. The fact that we happen to be humans is likewise an arbitrary reason to favor humans. If we favor humans, it is probably because we are biased. The pleasure of another species is still pleasure, and should count as much as that of a human, adjusted for its intensity and duration. The same point holds for preference satisfaction.

Species-egalitarian frameworks can still place more intrinsic value on members of certain species. A typical human life might have more positive subjective experience or preference satisfaction than a typical chicken life, simply because humans live longer and are more cognitively advanced. A species-egalitarian utilitarian framework would thus typically favor saving the life of a human over the life of a chicken, even while it would oppose acts such as causing a chicken to suffer immensely just so a human can eat chicken or eggs instead of a perfectly good vegan meal.

2.3 Location

Should intrinsic value be weighted equally across all locations in space and time? For example, is the life of a human worth more if it occurs here-and-now instead of there-and-later? Ethical frameworks that weight intrinsic value differently across locations can be said to *discount* intrinsic value (Price 1993; Portney and Weyant 1999; Perrings and Hannon 2001). A location-egalitarian consequentialist framework would weight all intrinsic value equally regardless of where or when they occur.

It is sometimes argued that intrinsic value should be discounted across space and time, for example because people have special duties to those closer to them (Cowen and Parfit 1992; Smith 1998). However, I would argue for location-egalitarianism. The argument here has the same logic as my argument for species-egalitarianism: it is an arbitrary coincidence which location we happened to be born into, and whatever phenomenon is intrinsically valued is still the same phenomenon regardless of its location.

Location-egalitarian frameworks can still favor some locations over others for instrumental reasons. We are often more capable of helping those near us than those distant from us. For example, I might help carry my neighbor's groceries, but I will not do the same for someone in another city. This does not mean I place more intrinsic value on my neighbor. It just means that, given my own instrumental capabilities, I can bring about more intrinsic value by helping my neighbor.

3. Opportunities in Outer Space

Earth is limited in both space and time, whereas the rest of the universe is much larger. Intuitively, this would suggest large amounts of intrinsic value could be accrued in outer space, especially under a location-egalitarian framework. However, this does not necessarily mean that outer space holds great opportunities for humans.

The consequentialist argument for space colonization has two parts. First, it must be the case that space colonization brings an increase in intrinsic value. This is to say that space colonies would be an improvement over whatever would otherwise exist. A colony on Mars, for example, would be better than an uncolonized Mars. Second, the improvement must be large enough to justify the effort it takes to colonize space. In other words, space colonization must not be so difficult that there are better options to increase intrinsic value on Earth. A Mars colony, for example, could be quite expensive. That same money could be used for other purposes, for example to reduce poverty. Only if space colonization is the best use of available resources can a consequentialist case for it be made. This section evaluates these two parts for the range of consequentialist frameworks.

3.1 Does Space Colonization Increase Intrinsic Value?

Whether space colonization is an improvement depends firstly on what holds intrinsic value. Space colonization changes the character of extraterrestrial environments from (apparently) abiotic systems to places populated with intelligent life. Space colonization is thus more likely to be an improvement if intrinsic value is placed on some aspect of intelligent life, such as subjective experience or preference satisfaction.

Space colonization would also typically be an improvement if ecosystem flourishing holds intrinsic value. Even a single human body contains a diverse ecosystem of microbes plus the human life. A single human could thus bring a significant increase in ecosystem flourishing to an uninhabited planet, depending on the precise formulation of "ecosystem flourishing". For an inhabited planet, the net effect depends on how the colony affects the indigenous biota. Cockell (2005) explains that if the indigenous biota is intrinsically valued, then space colonization can still proceed if the colony does not harm the biota; furthermore, space colonization should proceed if the colony can help the biota, such as by bringing it nutrients that can help it live and thrive. This is a reasonable position, but it does not resolve the issue of how to make tradeoffs between indigenous and colonizing ecosystems. Is it ever permissible for space colonization to proceed if it harms indigenous biota? The ecocentric consequentialist would say yes, it is permissible if it results in a net increase in ecosystem flourishing.

If intrinsic value is placed exclusively on abiotic systems, then space colonization is unlikely to increase intrinsic value. Indeed, it may even decrease intrinsic value, especially if undisturbed abiotic systems hold greater intrinsic value. This logic is found, for example, in the preservation ethic of Rolston (1986, p.170), arguing against space colonization on grounds that "humans ought to preserve projects of formed integrity, wherever found". Fogg (2000) makes a compelling counterargument on grounds that humans are part of nature, meaning that there is no clear baseline state of nature that should be preserved.

An instrumental argument can be made against at some space colonization, even if the extraterrestrial body holds no intrinsic value. Cockell (2005) describes that (1) an undisturbed extraterrestrial body can be instrumentally valuable, for example as an object of scientific study, and (2) visiting the body can be harmful to humans or to Earth, for example if it infects Earthlings with an extraterrestrial disease (i.e., back contamination). Taking these instrumental

factors into account, space colonization should not be completely avoided, but it should proceed with caution. Colonization permanently ends billions of years of isolation. Humanity should seek to realize what instrumental value exists in undisturbed extraterrestrial environments before it is too late.

What about different weightings of species? An anthropocentric ethics would tip the scales even further in favor of space colonization. In anthropocentric ethics, space colonization would be an improvement unless it harmed humans, for example via back contamination. The same logic applies to an ethics that only intrinsically values Earth species. Alternatively, an ethics that only places intrinsic value on extraterrestrial species would be categorically against space colonization if there is even any chance that extraterrestrial species could be harmed. Meanwhile, a species-egalitarian ethics would tend to favor space colonization, unless it only intrinsically values abiotic systems.

Finally, on different weightings of location: An ethics that favors nearby locations in space and time would diminish the intrinsic value of space colonization. But as long as distant locations still hold some intrinsic value, space colonization could still be an improvement. However, if an ethics only intrinsically values locations on Earth, then the only potential value of space colonization would be instrumental. For example, an asteroid mining industry would be free to pollute outer space as long as it improves conditions on Earth. This would suggest little merit for space colonization. An Earth-only ethics also implies that the lives of astronauts hold no intrinsic value while they are in outer space. As with species-egalitarianism, a location-egalitarian ethics would tend to favor space colonization.

In summary, consequentialist ethics will typically conclude that space colonization is an improvement. The core exceptions will be specific cases in which the colony harms the colonists or in which indigenous biota are harmed more than the colonists are helped.

3.2 Is Space Colonization Worth the Effort?

Space colonization may bring an increase in intrinsic value, but it is of course not the only activity that can. Consequentialism typically argues that individuals should act so as to bring about the best consequences, meaning the largest increase in intrinsic value. Consequentialism will thus only recommend space colonization if it brings the largest increase *per unit effort* relative to other options. Otherwise, our effort is better spent elsewhere.

Space colonization is notable because it may be able to bring utterly immense increases in intrinsic value. Early colonies might start small, given that other planets and moons have inhospitable environments. However, it may be possible to build large indoor colonies or create more hospitable outdoor environments (i.e., terraforming). Even just on other planets and moons in the Solar System, space colonies could multiply the total area available for human habitation. And there are many more planets around other stars, as ongoing research on exoplanets is now learning. One recent study estimates 22% of Sun-like stars have Earth-like exoplanets (Petigura et al. 2013), implying billions to tens of billions of potentially habitable planets across the galaxy.

Opportunities at any given star may also be quite a bit greater than those available only on planets. Earth only receives about one two-billionth of the Sun's radiation. To collect all the Sun's radiation, humanity would need a Dyson swarm (named after Dyson 1960), which is a series of structures that surrounds a star, collecting its radiation to power a civilization. A Dyson swarm around the Sun could potentially enable a civilization a billion times larger than is

possible on Earth. Likewise, Dyson swarms around one billion stars would bring humanity approximately 10^{18} (one billion-billion) times more energy *per unit time*.

Space colonies could also increase the amount of time available for human civilization. Earth will remain habitable for a few billion more years (O'Malley-James et al. 2014). Stars will continue shining for about 10^{14} more years (Adams 2008). That gives us an additional 10^5 times more energy, for a total of 10^{23} times more energy than is available on Earth. After the stars fade, other energy sources may be available. And even if our current universe eventually becomes uninhabitable, it may be possible to move to other universes (Kaku 2005). The physics here is speculative, but it cannot be ruled out, and hence there is a nonzero chance of a literally infinite opportunity for space colonization (Baum 2010a).

Whether the opportunity is infinite or merely, say, 10^{23} times larger than what can be done on Earth, the opportunity is clearly immense. As long as space colonization is an improvement (Section 3.1), then it would seem that the consequentialist should prioritize space colonization. The sooner space colonization begins, the more of its immense opportunity can be gained. Indeed, Ćirković (2002) estimates $5x10^{46}$ human lifetimes are lost for every century in which space colonization is delayed.

There can also be large value for space colonization under ecocentric intrinsic value. It is sometimes argued that Earth would be better off without humans. For example, the Voluntary Human Extinction Movement states that "Phasing out the human race by voluntarily ceasing to breed will allow Earth's biosphere to return to good health" (http://vhemt.org, accessed 25 October 2015). However, this makes sense only if extraterrestrial locations are not intrinsically valued. Otherwise, exterminating humanity ruins the opportunity for humans to bring flourishing ecosystems into outer space. Terraforming other planets or bringing ecosystems into Dyson swarms could bring immense amounts of ecosystem flourishing.

What about the cost of space colonization? It is true that space missions are very expensive. Today's space missions commonly cost billions of dollars, and these are small relative to what would be needed for a Dyson swarm or galactic civilization. A cosmic civilization might bring 10^{23} times more opportunity, but if it also costs 10^{23} times more than, say, reducing poverty, then it might not actually be worthwhile.

The exact cost of building an immense cosmic civilization cannot be calculated given present knowledge. Indeed, it is not presently known whether building it is even possible. Building it would involve technologies and procedures that do not yet exist and cannot yet be costed. Therefore, the cost-effectiveness of space colonization cannot yet be estimated with any precision. (This holds whether cost is measured in terms of money, effort, or anything else.) This ambiguity would seem to be stifling for consequentialism.

The ambiguity can be resolved by the fact that space colonization is a long-term project. Humanity is just not going to build an immense cosmic civilization any time soon. Today's most ambitious plans call for tiny extraterrestrial colonies such as the Mars One project for a permanent settlement on Mars. Such colonies are a far cry from the immensity of a galactic civilization. Building and populating something immense will take a lot of time.

It therefore follows that actions today should focus not on immediate colonization per se, but instead on enabling colonization sometime in the future. This can be done, for example, by developing technologies that can be used for space colonization. Such technologies lower the cost of colonization so that it eventually becomes worth the effort. Transformative future technologies such as atomically precise manufacturing (Drexler 2013) are especially worth pursuing.

Another productive means of enabling future space colonization is by keeping human civilization intact. Space colonization cannot proceed if human civilization does not exist. Even if humanity is not completely extinct, it will take an advanced civilization to colonize space. Threats such as nuclear war, pandemics, global warming, asteroid impacts, and supervolcano eruptions are among the threats that have the potential to knock human civilization out. Thus, if the goal is eventual space colonization, an essential priority is avoiding civilization's collapse (Asimov 1979; Ng 1991; Tonn 1999, 2002; Bostrom 2003; Baum 2009, 2010a).

For several reasons, the main priority today should be keeping human civilization intact. First, civilization today faces an alarmingly long list of alarmingly urgent threats. Our survival is hardly guaranteed. Second, any other activities we might pursue depend on civilization's continued existence. Advanced technology, space exploration, colonization—all of these things can be pursued at any time as long as civilization still exists. While there is large value in hastening space colonization (Ćirković 2002), the value of avoiding destruction may be even larger. Whether it is larger depends on the details, which could take a lot of work to evaluate. A third reason is thus to continue evaluating the best options and charting its course. Thus, while space colonization may be worth pursuing now under certain exceptional circumstances, under most circumstances the priority should be keeping civilization intact.

4. Extraterrestrial Intelligence Encounter

At the end of Section 3.1, I concluded that consequentialism will typically find space colonization to be good unless it harms the colonists or if it harms indigenous biota more than colonists are helped. The possibility of encounter with indigenous biota—with extraterrestrial life—could result in harm to either. It could also result in benefit to either. But which would it be? And what does that mean in practical terms for human actions right now? This section answers these questions for the range of consequentialist frameworks and specifically for encounter with extraterrestrial intelligence, ETI. Non-intelligent extraterrestrial life is also important, but ETI have especially meaningful implications in the context of consequentialism.

4.1 Encounter Scenarios

Encounter with extraterrestrials is a common theme in science fiction, but its nonfiction study is fraught with uncertainty. We humans just do not know what extraterrestrials would be like and how they would react to us. We thus should resist the temptation to predict how an encounter would proceed. Instead, the best we can do is to consider a range of scenarios and logically evaluate the consequences of each.

Surveys of encounter scenarios are provided in Michaud (2007) and Baum et al. (2011). Baum et al. (2011) use an anthropocentric consequentialist perspective, assessing whether encounter would benefit or harm humanity. A core point is that an ETI is likely to be more advanced than humanity, because human civilization is young relative to astronomical time scales. That means that the ETI would likely (but not necessarily) get what they want. For this reason, it is important to consider what they might want—that is, what their ethics are.

Competing narratives of extraterrestrial encounter assume that ETI would either seek to help or harm humanity. The "seek to help" narrative tends to emphasize humanity's more altruistic or egalitarian tendencies. It often posits that more advanced civilizations will tend to be more egalitarian, or at least that non-egalitarian civilizations are more likely to self-destruct from misuse of dangerous technologies (Sagan and Newman 1983). The "seek to harm" narrative

tends to emphasize humanity's more selfish and anthropocentric tendencies. It often observes that colonization throughout history frequently ends poorly for the colonized (Diamond 1999).

In general, one might think that a species-egalitarian ETI would seek to help whereas an ETI that only intrinsically values itself would seek to harm. However, that is not necessarily true.

A species-egalitarian ETI may not seek to help humanity. It could just leave humanity alone, concluding that helping us would not be worth the effort. This would hold in particular if it does not intrinsically value locations on or around Earth, or if it does not intrinsically value any aspect of humanity. Indeed, an ETI that favors abiotic systems may even seek to destroy humanity and the rest of life on Earth. Alternatively, an ETI that favors ecosystem flourishing could seek to destroy humanity to restore Earth ecosystems or to install other ecosystems on Earth. Finally, an ETI that favors subjective experience or preference satisfaction could seek to destroy humanity because humans are not as capable at having positive subjective experiences or satisfied preferences. Just as a species-egalitarian could value the life of a human more than that of a chicken, so too could it value the life of an ETI more than that of a human.

A species-egalitarian humanity could seek to destroy the ETI for the same sorts of reasons. Alternatively, either civilization could seek to destroy itself upon encounter with the other. For example, suppose humanity learns that the ETI is much more capable of having positive subjective experience than humans can. Humanity could destroy itself in order to free up space in the universe for the ETI to have more positive subjective experience. Now suppose that the ETI intrinsically value ecosystem flourishing, and suppose that it concludes that humanity is better at maintaining flourishing ecosystems. In this case, both civilizations would want to destroy themselves. A race to be the first to self-destruct could ensue (Baum 2010b). This may sound absurd, but it is a logical consequence of certain basic consequentialist frameworks. Furthermore, upon closer inspection it may not seem so absurd, as it is just a particular case of sacrifice for the greater good.

An ETI that only intrinsically values itself may likewise not seek to harm humanity. Again, it could just leave humanity alone. Alternatively, it could find pleasure in humanity's ongoing existence. This is seen for example in the zoo hypothesis scenario, in which the ETI watch humans just as humans take watch nonhuman animals in zoos. A self-valuing ETI is less likely to instrumentally value humans for our capabilities because we are likely to be so much less advanced. We should not count on being able to trade with ETI, just as chickens cannot count on trading with us. Finally, the ETI could keep humans alive to eat us, though distant planets are a long way to go for a new source of food, and our chirality might not be compatible with theirs (Cockell and Lee 2002). Whether this would be a harm to humanity depends on how they would treat us as livestock. While humanity's treatment of livestock is not encouraging, that does not necessarily mean the ETI would behave similarly.

These scenarios are illustrative of the range of ways an ETI encounter could play out. They show how sensitive the outcome is on the ETI's ethics, and potentially also on humanity's. Studies of ETI encounter should have ethics front and center.

4.2 Practical Implications

Humanity is not currently in contact with any ETI. However, ETI contact scenarios are nonetheless relevant to at least two types of current human activities: space exploration and treatment of nonhuman animals.

For space exploration, the key message is caution. An ETI encounter could bring major consequences, but those consequences could be either good or bad. That is, they could bring

either a large increase or a large decrease in intrinsic value. Humanity should seek the increases and avoid the decreases. Unless we know which is which, we should try to learn more before taking major actions. This point holds across the range of different consequentialist frameworks.

One contemporary decision in which caution is warranted is messaging to extraterrestrials (METI). Sufficiently powerful electromagnetic radiation from Earth can be detected from other points in the galaxy. This includes (1) background leakage from radio and television transmissions intended for Earth audiences, which can unintentionally reach ETI, and (2) messages intentionally sent to ETI. The term METI typically refers to intentional messages.

The consequences of METI depend on signal strength and duration. Stronger and longer signals are more likely to be received by ETI and result in an encounter. Strong signals stand out more from background radiation. Long duration signals, usually done as a repeated signal, are less likely to be interpreted by ETI as an equipment glitch or other false alarm. A sufficiently low-strength, short-duration METI message blends in with background leakage and does not appreciably change the likelihood of ETI encounter (Haqq-Misra et al. 2013). Any ETI that receives these signals presumably already knows about humanity. The signals are thus unlikely to affect the possibility of ETI encounter. Instead, their value is mainly for education on Earth.

In contrast, high-strength/long-duration METI signals are likely to be received by ETI who would not already be aware of humanity. These signals could lead to ETI encounter and are thus of higher consequence. There is an active debate on the question of whether high-power/long-duration METI should be conducted (Shostak no date). In consequentialist terms, whether METI should proceed depends on whether an ensuing ETI encounter is more likely to be beneficial or harmful, as well as how beneficial or harmful it would be. However, this is very difficult to know because we now have little understanding of what an ETI would be like.

In this situation, the best course of action in consequentialist terms (for the range of different consequentialist frameworks) is to abstain from high-power/long-duration METI in order to evaluate its merits. There is no urgent reason to start high-power METI. It can wait. Once the signals have been transmitted, we cannot take them back. It is thus worth pausing to try to better understand the merits of high-power/long-duration METI. To be sure, gaining a better understanding may be difficult, since it will have to proceed without evidence from any actual ETI encounter. But some progress may be achievable via philosophical inquiry, or from other astrobiological research, such as the ongoing study of exoplanets. Finally, any educational value of high-power/long-duration METI could, more or less, be achieved by a high-visibility study of its merits. Given how high the stakes of ETI encounter would be, this cautious approach is best.

The second practical implication is for the treatment of nonhuman animals on Earth. Humanity often treats nonhuman animals poorly, and justifies it on grounds of human superiority. It is undoubtedly true that humans are superior in certain regards—for example, no other species are exploring outer space. However, humans are not categorically superior, despite some tendencies to place "humans" and "animals" in different categories. (The reader might note my repeated use of the term "nonhuman animals" to emphasize our common lineage.) Humans may be the most intelligent, the most technologically capable, even the most capable of enjoying positive subjective experience or satisfying preferences. But some other species can do these things too.

Whatever humans can do better than nonhuman animals, ETI may be able to do better than humans. Indeed, ETI are likely able to do these things better, because ETI are likely to be much older as a civilization and thus more advanced than humanity.

5. Conclusions

A basic conclusion of this paper is that consequentialists should pay attention to outer space. This is because outer space can be the location of immense consequences (via space colonization) and because outer space scenarios can force us to rethink our consequentialist ethics (via ETI encounter).

Attention to outer space prompts us to recognize the big picture. This holds for consequentialist ethics as much as it does for anything else. Only by thinking through the possibilities of outer space can we understand how our lives could matter in the grand scheme of things. And the fact of the matter is that our lives can matter immensely. We can set the pieces in motion for an immense cosmic civilization. We can help prevent civilization-ending global catastrophe so as to enable future space colonization. And we can determine whether or not to try messaging to ETI.

Should we do these things? Answering this all-important question requires ethics. Therefore, just as consequentialists should pay attention to outer space, so too should outer space analysts pay attention to consequentialism, and indeed to ethics in general. Defensible forms of consequentialism will generally conclude that (1) humanity today should focus on avoiding global catastrophe, (2) space colonization should proceed with caution, but ultimately should proceed at immense scale, and (3) high-power/long-duration METI should not be conducted until more effort is put to assessing whether the consequences are likely to be good.

The ethical arguments and empirical analyses in this paper are quite brief and are not the final word on the subject. I have said little in defense of consequentialism and my preferred form of it. The analyses of space colonization and ETI encounter are likewise at best only approximate and leaving much for future work. Some of it is due to space constraints in this paper, but much of it is due to the fact that the research simply has not yet been performed. Outer space consequentialism could make for a fruitful line of inquiry.

The merits of this line of inquiry are diminished by the conclusion to focus on avoiding global catastrophe. Any global catastrophe would preclude the possibility of future research on all topics, including outer space consequentialism. Likewise, any hopes of resolving the ethical dilemmas and empirical uncertainties depend on us surviving long enough to do the research. An argument can thus be made against any work on outer space in favor of work on the global catastrophic risks. My own view is that work on outer space should be pursued mainly to the extent that it is instrumentally valuable towards reducing the global catastrophic risks. To that end it can be quite instrumentally valuable. Outer space can offer great motivation due to its immense opportunities, and it can be deeply inspirational due to its beauty and wonder and the big-picture perspective it offers. While attention to outer space should not distract humanity from the urgent threats that it faces, some attention is very much worthwhile.

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