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Artificial Minds and Human Religions

An Illustration of the Diversity of Possible Intersections Between Religious Thought and Practice and Technological Advances

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The message encapsulated in the phrase "There is only one God" is a familiar one, and most of us, upon hearing it, would associate it with some great human religious leader such as Moses or Muhammad. In the current reinvention of the science-fiction series *Battlestar Galactica*, however, this viewpoint is expressed not by humans (who, in the series, practice a form of polytheism related to that of the ancient Greeks), but by the Cylons, a race of machines originally created by humans but which evolved and rebelled. A survey of recent science-fiction would show that the theme of this paper — artificial minds and human religions — is one that is of significant interest in our time. As this conference relates to not only religion and science, but also to *art*, the inclusion of artistic works of film and television (ones that have also inspired some of the great musical compositions of the 20th and 21st century as well) seems appropriate. Furthermore, science-fiction provides an opportunity to explore future possibilities, and exploring where technology *might* take us and how religious traditions *might* respond seems more advisable than waiting until developments actually occur, and then scrambling to respond.

It is better to explore and reflect on these issues before they become a pressing contemporary issue.[1]

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1. On this see further Daniel Dinello, *Technophobia* (Austin, University of Texas Press, 2005), pp. 5, 275; also James F. McGrath, "Religion, But Not As We Know It: Spirituality and Sci-Fi", in C. K. Robertson (ed.), *Religion as Entertainment* (New York, Peter Lang, 2002), pp. 153-170.

Artificial intelligence, obviously, is one field of science and technology in which the predictions of both scientists and science-fiction authors have failed to materialize as rapidly as some had anticipated.[2] Nevertheless, current research seems to be moving in a more promising direction. Initial forays into the field of artificial intelligence attempted to program a thinking machine line by line, command by command. Yet the intelligences we encounter in the world around us — whether our own and those of other human beings, or the most rudimentary ones of insects and other organisms with which we share this planet's biosphere — are not made that way. While it is true that brains begin with some "software" already installed, as it were, even the most rudimentary brains are able to learn and respond to stimuli and their environment. It is also the case that, inside the brains, neurons are wired in networks, and not in a purely linear arrangement. Recent work with neural networks has indeed produced machines capable of learning and adapting to the world around them. Although they are a long way even from the most rudimentary animal intelligence, the results are nonetheless promising and intriguing.

Moreover, recent studies have shown how evolution *outdoes* design, not only in the natural world, but in software.[3] Programs that are created and left to learn and explore for themselves fare better than our own attempts at creating software solutions "bit by bit" — if you'll excuse the pun. Computers and programs *that currently exist* can already learn and evolve solutions themselves in a rudimentary fashion. What is most remarkable is that, when they are given the opportunity to do so, they cannot only produce *better* results than humans have been able to, they can produce results that human beings *cannot even understand*! A genetic program is one that is designed to learn and develop, and allowed to do so and find its own solution to a problem. Such programs already exist, and one was given the task of evolving a computer code that accurately interprets a patient's nerve signals and converts them into the desired movements in a prosthetic hand. The result was "a single line [of computer code] so long that it fills an entire page and contains hundreds of nested parenthetical expressions. It reveals nothing about why the thumb moves a certain way — only that it does".[4]

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2. As I have noted elsewhere. See my "Robots, Rights and Religion" (forthcoming).
3. James Gardner, *The Intelligent Universe*, p. 41. One thinks at this point of the recent tendency of scientists to allow natural selection to get bacteria to produce an enzyme or other organic substance, rather than trying to engineer the chemical themselves.
4. W. Wayt Gibbs, "Programming with Primordial Ooze", in *Scientific American* (www.genetic-programming.com/published/scientificamerican1096.html); quoted in Gardner, *The Intelligent Universe*, p. 42.

All of this results from an attempt by those scientists and engineers working in the field of artificial intelligence to emulate natural intelligence more closely. This is a logical starting point. While human technology has accomplished some remarkable things, nearly all of it at least began by *copying* that which is found in nature. Flight, antibiotics, lenses, computers — all of these technologies have their origins in the attempt to replicate things found in the natural world.[5] And thus we can expect that, if there ever is an example of the creation of an artificially *sentient* machine, it would in the first instance be an attempt to emulate our own brains. One obvious religious implication of such technology would be the discussions that would inevitably ensue over whether or not such machines *had souls*.[6] On the other hand, the development of artificial minds might itself be sufficient to persuade us whether what we have traditionally denoted with terms such as *soul* and *mind* are indeed emergent properties of our brains.

Matters are complicated, however, by the fact that sentience and consciousness are subjective experiences. We attribute them to other human beings because we have them ourselves, and it seems a justified assumption that other human beings experience their own consciousness in the same way. When it comes to animals, however, there is no agreement (either among philosophers or among biologists) regarding whether animals have even a limited degree of self-awareness. Likewise, there has been disagreement in some religious traditions over whether animals have "souls". We shall not attempt to answer such questions here. Since one's own subjective experience is not something science is able to study, it would seem warranted to adopt the following principle: if human beings create an artificial brain, and the machine in which the brain is located interacts with us in a manner similar to what we would expect in interactions with other humans, we *must* assume that the machine in question has the same sort of self-awareness we have, if it *behaves* as though it does or *claims* to.[7] The "must" in that statement (and in the one that follows) is a *moral* assertion. Such a machine, if we wish to be at all ethical and *humane*, must be treated as a person, as our *offspring* rather than our mere creation.

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5. Indeed, Seth Lloyd, in his recent book *Programming the Universe* (New York, Alfred A. Knopf, 2006), suggests that the universe is itself a computer of sorts. Our intention is not to suggest that attempts to emulate nature are always successful or have the most efficient results. Attempts to build flying machines based on the flapping wings of insects and birds were notoriously ineffective. Nevertheless, the principle of emulation and its use as a starting point remains a key component in many areas of technology.

6. For the idea of a "spiritual turing test", see McKee, *The Gospel According to Science Fiction*, p. 61, discussing Jack McDevitt's powerful story *Gus*.

7. See further James F. McGrath, "Robots, Rights, and Religion" (forthcoming); Justin Leiber, *Can Machines and Animals Be Persons?* (Indianapolis, Hackett Publishers, 1985).

Science-fiction has regularly explored scenarios involving the existence of sentient machines (sometimes called "androids", although the term is reserved by some authors for machines that *simulate* human behavior without having the inner reality).[8] Often, the machines in question have human or human-like *thoughts*, but not *emotions*. On the one hand, it is clear that our experiences of emotion involve not merely brains, but a more elaborate ensemble of body chemistry — adrenaline, serotonin, and endorphins, to name but a few — and therefore if we do not provide our sentient machines with appropriate "body chemistry", they will indeed not share in the same sorts of emotional experiences as ourselves.[9] On the other hand, given that evolution developed such emotional instincts long before it gave us our current cognitive abilities, it is unclear whether it would even be possible to produce an "emotionless mind".[10] It may even be the case that what we experience as our inner subjectivity or *qualia* may depend on the interaction of what might be considered multiple *brains* — the limbic and the neocortex.[11] For the sake of this paper, let us assume that what we are talking about is a complete artificial *person* modeled on humanity both in form and in content.[12] This is a fair assumption, since

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8. See Philip K. Dick, *The Shifting Realities of Philip K. Dick* pp. 185, 209-211; Gardner, *The Intelligent Universe*, p. 78. It should be noted that it is customary to speak of *androids* (derived from Greek *anēr* meaning male as opposed to female) rather than *anthropoids*. I will be the first to admit that "androids" sounds better, but one cannot help wondering whether this is intentional and reflects traditional assumptions about men and women and their respective roles and characteristics. Are androids simulations, not merely of humanity, but of "maleness", capable of rational computation and impressive feats of strength, but not of empathy and nurturing? Certainly our values have changed since the concept of the android was first introduced, and whereas a fully rational entity such as Mr. Spock on the original *Star Trek* series could be an ideal to strive for, by the time of the making of *Star Trek: The Next Generation*, Data is presented as an android who has precisely those characteristics — he can think, compute at lightning speed, and so on — yet longs to be human, to experience emotion. One wonders, however, whether this depiction of Data is coherent. Could an android lacking all emotion really *long* for them? Be that as it may, the development between the *Star Trek* series allows us to track certain cultural developments.

9. See for example the discussion of this aspect of Robert Sawyer's novel *The Terminal Experiment*, in Gabriel McKee, *The Gospel According to Science-Fiction* (Louisville, Westminster John Knox, 2007) p. 47.

10. The focus, in the U.S., on AI independent of robotics has been critiqued for assuming that there can be disembodied intelligence. See Robert M. Geraci, "Spiritual Robots: Religion and Our Scientific View of the Natural World", in *Theology and Science*, 4:3 (2006), pp. 231-233; Anne Foerst, *God in the Machine*, New York, Dutton, 2004.

11. See, *e.g.*, the brief example of evidence for the human brain being a "distributed system" in Foerst, *God in the Machine*, p. 140; also Dean Hamer, *The God Gene* (New York, Anchor, 2004), pp. 98-102.

12. A recent article suggested that people are more comfortable interacting with a robot that is 50% human in appearance than one that is 99%. Somehow, that 1% difference

science, as we have noted, regularly begins by seeking to *emulate* that which is found in nature, before trying to *improve upon it*. Let us mention at this juncture, however, that unlike developments in transportation, if we create sentient intelligent machines, it will not be solely up to us to improve upon them. Such "beings" (for we must call them that) will be or will become capable of self-programming (for that is what all learning is, in one form or another), and we may expect them to evolve rapidly and to become beings that we may not have words to describe other than *god-like*.[13] These beings, their inner subjective experience, and their religious ideas will all become incomprehensible to us, as they approach what Vernor Vinge (and, more famously, Ray Kurzweil) called "singularity".

Nevertheless, for that period in which machines are fully made in our image, however brief it may turn out to be, we should expect them to explore all those aspects of life, those practices and experiences, that make us human, and we would thus find artificial persons exploring the texts and traditions of the world's religions. And so it is now that we come to the focal point of this paper: what might artificial machine persons make of our religions? In the first instance, they might well make of them just that which human beings in general make of them — no more, no less. But surely they, like all other children, would learn through emulating their parents, at least in the first instance, and thus we can expect artificially intelligent machines to express curiosity and get involved in the religious practices and customs of their creators. There are thus some intriguing questions and possibilities that are worth exploring through hypothetical scenarios.[14]

In what follows, we shall begin with scenarios in which androids are more-or-less like their human creators, occasionally moving off this main

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is distracting, making one feel as though one is talking to an animated corpse rather than a person. See, in particular, Masahiro Mori's famous essay "The Uncanny Valley" (1971), as well as the more recent study by Jun'ichiro Seyama, "The Uncanny Valley: Effect of Realism on the Impression of Artificial Human Faces", in *Presence* 16 (4), pp. 337-351. See also Foerst, *God in the Machine*, pp. 99-100.

13. See, for instance, what Michael Shermer has called "Shermer's Last Law", namely that "Any sufficiently advanced extraterrestrial intelligence is indistinguishable from God" (http://www.sciam.com/article.cfm?articleID=000A2062-66B1-1C6D-84A9809EC-588EF21).

14. Although it might be argued that I am giving too much credence to technophiles and the views of technological optimists, if one is to explore this question at all, it is necessary to take a maximalist approach to the potential technological developments. If technology proves incapable of replicating the brain, and sentience in the process, then many of the points discussed in here become moot. Exploring the "what if" questions remains useful in the mean time, as a thought experiment allowing the exploration of significant issues.

thoroughfare of investigation to explore side-roads involving androids (which is what I will call sentient machines so as to not have to repeat other more cumbersome phrases) that differ from us in particular ways.

Christianity

As I began pondering the possible interactions of androids with my own religious heritage, Christianity, I was disappointed to find that most of the scenarios I could initially imagine were not entirely positive. There is much that could be potentially off-putting, or at the very least not particularly appealing, from an android's perspective. To begin with, the emphasis on incarnation, more precisely on the divine Word becoming *flesh*, could immediately leave androids alienated and their status ambiguous. Of course, if the history of Christianity is anything to judge by, then debates are a certainty regarding whether androids even have souls, whether they can be saved, whether they can be ordained, and other such topics.[15] Would the fact that androids were made of artificial flesh, or perhaps not of flesh at all, lead organic human Christians to conclude that God has done nothing to accomplish their salvation — and, in turn, also lead androids to reject summarily the Christian tradition?[16] It is impossible to know for certain, but just as there would surely be denominations that would see no reason to welcome androids or to accommodate them theologically, there would also be other denominations that would expand their already-existing emphasis on inclusiveness to make room for artificial people, just as they have made room in the past for every conceivable category of human persons.[17] This would not be as theologically problematic as might first appear. After all, if *natural, biological* copies of Adam are regarded as preserving something of the divine image, then why would *artificial, mechanical* copies potentially not do so as well?

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15. A scenario involving the election of the first robot as a Pope in the Catholic Church is explored in Robert Silverberg's story *Good News From The Vatican*.

16. In the Orthodox tradition, the incarnation is itself salvific. In this context it is appropriate to recall Bulgakov's discussion of the salvation of angels. Just as he creatively managed to find salvation for angels in the man John the Baptist becoming angels, Orthodox theologians might find other creative ways of concluding that God had provided for android salvation, presumably in a way that is ultimately connected to the salvation of humankind through the God-Man. In a Protestant context, since in Protestantism the death of Christ as atonement is more central, the question might rather be whether the sacrifice of Jesus' human life covered the sins of androids.

17. One can readily imagine extreme bigotry against androids being justified by appeals to religion — just as bigotry against other humans has often been justified in this way. See further Dinello, *Technophobia*, pp. 75-78; Foerst, *God in the Machine*, pp. 161-162.

If androids were superior in some ways to their human creators — in intellect, for example — then it might prove desirable enough to attract androids into one's religious tradition and community that even those less inclined to do so would find ways of circumventing the hurdles.[18] Yet on the flip side of this point, those denominations and churches that treat faith as something not merely *beyond reason*, but *irrational* as well, might find it difficult to attract androids, who would presumably be modeled, one expects, on the best examples of human rationality.

The question of rationality and faith raises the topic of *heresy*. Many doctrines need to be appreciated as symbols and metaphors, so if androids are to be capable of religious sentiments and beliefs at all, then their capacity for symbolic as opposed to merely literalistic thinking would be essential.[19] While we might briefly entertain the possibility that super-logical and ultra-literal androids might be enlisted in the service of fundamentalism, such a frightening scenario is extremely unlikely. Although fundamentalists of various sorts *claim* to believe the whole Bible and take it literally, none in actual fact do so. In all likelihood, if androids were inclined to be extremely literal, they would quickly discover the selectivity of fundamentalism's self-proclaimed literalism and reject it. More plausible, perhaps, are scenarios in which androids might assume that, if the Word became flesh in the era of fleshly persons, so the Word must become *metal*, or *machine*, in the era of artificial and mechanical persons. Whether this would lead to an expectation of a "second coming", or even to a Messianic status being attributed to some artificial person, would require a lengthy story to do justice to the speculative scenario, but the possibilities, and their potential impact on human religious communities, are intriguing.

On a more basic level, some of the more perplexing philosophical issues raised by androids in relation to Christianity have already been addressed. The creation of artificial persons would seem to indicate clearly that what Christians have historically referred to as the *soul* is in fact an emergent phenomenon and a property of the brain function, rather than a separate, incorporeal substance. But a great many Christian theologians are already moving in that direction based on a combination of biological, psychological, philosophical and Biblical motives.[20] The Bible itself speaks

18. Religious groups, once androids were legally declared persons, might see the benefit in funding the mass-production of androids pre-programmed with inclinations towards particular religious practices, as these could boost the membership levels of one's own faith to the level of "most popular"/"most adherents".

19. For all we know, some doctrines might seem more intelligible to an android, especially one that is capable of not merely interfacing with, but sharing an overlapping existence with, some other computer.

20. See the recent work of Biblical scholar Joel Green, for example.

of human beings more frequently as psychosomatic unities than in dualistic terms, and this classic "Hebrew" view of human beings fits well with the findings of recent scientific studies. This being the case, the question of whether androids have "souls" is no more perplexing than the question of whether *we* do, and, if so, in what sense.

In thinking about salvation from an android's perspective, what it might mean for an android to be "saved" or "lost" is a relatively natural discussion to have, since this terminology is already used in the domain of computing. Would androids have the capacity to make back-up copies not only of their data and memories, but the precise *configuration* of their neural networks, so that, in case of death, a new copy could be made that would continue from where the original left off? And more importantly, would such a copy, restored from backed-up software, be the *same person*? Such questions are important for discussions of *human* salvation every bit as much as for androids. Since it is difficult to envisage, on our present understanding of human beings, any way that a human personality might continue wholly uninterrupted into an afterlife scenario, the question of whether we ourselves or mere *copies* of ourselves would experience eternal life is an ongoing dilemma. Nevertheless, when it comes to another scenario, in which a human being wishes to transfer his or her mind into a machine and thus extend life indefinitely, a possible course that would allow continuity can indeed be envisaged. Our brains might be capable of maintaining continuity of experience and sense of self and personhood through replacement of brain cells, provided this occurs gradually. If it were possible, through the use of nanotechnology, to replace our brain's neurons cell by cell with artificial ones, over a period of years, might this not allow the personality to cross over into an artificial brain without loss of continuity? If so, then whatever one might make of discussions of machines sharing Christian salvation, the possibility of machine existence offering to human beings a technological alternative to such salvation, an ongoing embodied existence that avoids death rather than occurring after it, is a very real one. And of course, it might in fact prove to be the case that machine intelligences, needing not fear their own loss of existence even in the event of "death", would find no particular appeal in Christianity's promises of eternal life.[21]

There are other topics as well, that one might discuss.[22]

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21. See also Leiber, *Can Machines and Animals Be Persons?*, pp. 56-58.

22. For the sake of time, we shall set aside the possibility that fundamentalists would use the creation of artificial persons as a basis for some sort of "intelligent design" argument. Elsewhere I have considered the topic of whether a married person having sex outside of wedlock with an android would be considered *adultery*. See my forthcoming chapter "Robots, Rights and Religion".

Let me conclude the section on Christianity with a series of questions about which religious rituals, sacraments, and other sacred experiences we can imagine androids having. Could an android be baptized (assuming that rust is not an issue)? Could one receive communion? Could one be ordained? Could one lift its hands in worship? Could an android speak in tongues? Could it sit meditatively in a cathedral, as it listens to Bach, and have a genuine experience of the transcendent? For many of us, the instinct is to answer "no", but this may perhaps have more to do with our prejudices and lack of imagination, than an inherent android incapacity to experience these things in a meaningful way. In the end, much will depend on how closely they have been modeled on their human prototypes. Perhaps the creation of androids will benefit humanity precisely by forcing us to overcome such prejudices.

Buddhism

Let us now turn to another religious tradition, namely Buddhism. What would an artificial sentience make of the Buddhist four noble truths? Would it be able to relate to the notion that all life is suffering? Would it form the attachments to people and things that Buddhism diagnoses as the root cause of suffering? We can imagine multiple factors that might lead engineers to develop sentient machines that lack key human instincts, such as self-preservation or fear, in order to have them serve as soldiers, firefighters, rescuers, and so on.[23] Here we find new ethical questions arising, for it must be asked whether it is ethical to create persons who are made to sacrifice themselves for others. They may or may not technically be *slaves* of humans, but certainly would be regarded as *expendable*. The fact that the existence of machines designed for such purposes would be highly desirable from a human perspective does not mean that creating them is *ethically justifiable*.

From a Buddhist perspective, it would seem far easier to incorporate such new artificial beings into the Buddhist worldview, and thus for Buddhism to welcome robots as participants in its religious traditions. Individual personhood is considered an illusion, which provides a unique perspective on this topic. The only major hurdle will be the acceptance

23. Although I have not seen it, I am told that the *Ghost in the Shell: Stand Alone Complex* includes military tanks that develop sentience. The question of what might happen should an AI-tank develop a conscience and decline to fight is significant. A human soldier would be court-martialed; the tank could not simply be dismissed from military service to go and make a life for itself outside the army! On the ethics of terminating the existence of an AI, see once again Leiber, *Can Machines and Animals Be Persons?*

of these robots/machines as *living*, as opposed to *intelligent* or *sentient*.[24] Once that is established, Buddhist adherence to the possibility of reincarnation, and respect for *all* life, suggests that Buddhists will *value* artificial persons, however much they may be similar to or different from humans either psychologically, or physically. Indeed, the possibility of reincarnation as an intelligent machine would seem quite natural from a Buddhist perspective.[25] Furthermore, a machine that was created in such a way that it was able to show compassion for others, and yet form no attachments and take no thought for its own life, could conceivably be interpreted as a realization of the Buddha nature in an unprecedented fashion. One can imagine an amusing basis for a science-fiction story, one which nevertheless raises genuine issues, in which a group of Buddhists identify a robot fireman as a new incarnation of the Buddha, and engage in legal maneuvers to secure its release from service at the fire station to instead instruct Buddhists and serve as an example to them.[26]

On the one hand, if a machine person has all the characteristics of a human being, then it might well find meditation as helpful as ordinary persons do. On the other hand, the greater the differences between a machine and ordinary human beings, the greater the likelihood that traditional practices and teachings of any sort, Buddhist or otherwise, will be useless or meaningless for them.[27]

Atheism

One might be forgiven for going into a discussion of artificial intelligence and spirituality assuming that sentient machines would prove to be atheists, that is, wholly secular beings with no room for spirituality.

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24. The question of their soul and their attainment of Nirvana is less an issue here too, since in Buddhism the reality of our existence as distinct individuals is illusory, and on some interpretations Nirvana itself is closely connected to its root meaning of *being extinguished*. This subject is explored further in Leiber, *Can Animals and Machines Be Persons?*, pp. 19-21.

25. I will not venture to guess whether reincarnation as an android would be considered better than rebirth as a human being. Much would depend, one imagines, on the characteristics of androids themselves in relation to Buddhist ideals.

26. Robert M. Geraci (in *Spiritual Robots*, pp. 230, 237) mentions the view expressed by Masahiro Mori that a robot could have the Buddha nature. In the same article, Geraci explores how Japanese religious ideas, in particular Shinto, may be responsible for the widespread acceptance of the presence of robots in Japanese society (pp. 235-240).

27. On the role of brain and body chemistry in the experience of those practicing Buddhist meditation, see Andrew Newberg's *Why God Won't Go Away* (New York, Ballantine Books, 2002).

Such a prospect should be a cause for concern and not merely delight. Religious beliefs are expressions of human intuitions about transcendence, the meaningfulness of existence, and the value of persons. If it were assumed that machines would be atheists, this could only be because they were created without these particular human instincts and without the capacity for the emotional and intuitive responses that are characteristic of humanity.[28] Of course, it may turn out that without certain underlying emotional and intuitive capacities, sentience itself cannot exist. But if it *can*, then we do well to ask what machines would be capable of, that lacked these very human responses, but shared or surpassed our intellectual capacities. Atheists have long been concerned to show that it is possible to be moral without being religious, and no one seriously doubts this to be true. But might it not prove to be the case that morality, if not dependent on a religious worldview, depends nonetheless on the empathy and sentiments that give rise to religious perspectives? In other words, what would ensure that a pure intellect free of emotions did not eliminate human beings at whim, assuming it had the capacity (or could gain for itself the capacity) to do so? Since we have explored in this study scenarios in which humans may be unable to empathize with androids or regard them as fully persons, it is surely in our best interest to consider the possibility that intelligent machines may feel the same way about us as organic persons.

Scenarios involving intelligent but emotionless machines that do not share our value for human life are commonplace in science-fiction, from older films like *Colossus* to more recent ones like *Terminator 3*.[29] On the one hand, a machine lacking emotion might also be entirely lacking in selfish ambition, with the result that its likelihood of trying to take over the world is significantly diminished. On the other hand, such a machine, given a task such as finding a solution to environmental pollution, could surely be imagined eliminating humanity as the most economic and efficient "solution". Yet given that our current technologies already dominate us in a certain sense — our oil-dependent machines send us to war with some nations we might otherwise be allies with, and keeps us allied to nations whose ideologies are far from our own — it would not be unfair to suppose that *intelligent* machines might be more benevolent taskmasters.[30]

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28. Note Karen Armstrong's well-known statement that *homo sapiens* appears to have been from the outset also *homo religiosus*.

29. On robots and whether they might one day set aside human values, see Robert M. Geraci, *Apocalyptic AI: Religion and the Promise of Artificial Intelligence* pp. 11-12.

30. See further Dinello, *Technophobia*, p. 3.

It was Isaac Asimov who proposed that robots be programmed with key laws that would prevent them from harming human beings. But if they are sentient persons with *rights*, then would the imposition of such laws amount to indoctrination or even *brainwashing*, and if so, might it be possible for it to be legally challenged?[31] Interestingly enough, recent prominent atheists such as Dawkins and Dennett have raised questions about the unlimited right of parents to raise their children in what they consider harmful, irrational beliefs. But if it turns out that we cannot provide machines with a purely rational basis for morality, then would we have any choice but to limit their freedom and "indoctrinate" them in this way?

Conclusion

The scenarios explored in this paper may seem somewhat frivolous, but our attempt to inject an element of humor should not be misconstrued as indicating that the topic under consideration is not extremely serious. All of the scenarios we have explored are set in early stages in the development of artificial intelligence. If we assume that such artificial intelligences will have the capacity to learn and evolve at their own pace, then such a period will inevitably be short-lived. Within the time span of at most a few human generations, the superior computing and reasoning capacities of these machines would lead them to evolve so rapidly, that very quickly they would be beyond our understanding. At that point we might hope that these (hopefully benevolent) deities of our own creation might show respect for their creators and value them, perhaps even sharing some of their unique insights with us and providing us with solutions to technological, medical, transportation, and other problems that we could not develop on our own in the foreseeable future. If, before they leave us behind entirely, they provide us with means to extend human life indefinitely and to mold matter at whim, so that we may be able to tell a mountain to throw itself into the sea and it will do it, what will become of traditional human religions and their promises? Will whatever these machines can teach us about the nature and mystery of existence replace our own human traditions?

The reality is that an artificial intelligence left to its own devices would almost certainly progress and evolve so rapidly that it would presumably soon leave our human religious traditions behind. Indeed, we can easily imagine such artificial intelligences becoming *sources* of revela-

31. See Anne Foerst's discussion (*God in the Machine*, pp. 40-41) of whether such robots would be morally superior or inferior to human beings.

tion for human beings. Whether it begins with machines that decide to dedicate some of their underutilized computing capacity to work on some questions humans have traditionally found insoluble, or machines specifically programmed to investigate such matters, or machines that evolve to such a level that they encounter existential questions on their own, it is hard to imagine that artificial minds will *not* focus on such matters sooner or later. Once they do, and once their thoughts become as much higher than our thoughts as the heavens are higher than the earth, it seems likely that people will seek enlightenment from machines. *That* more than anything else will potentially dethrone us from the last bastion of anthropocentrism. But it will be no real surprise — our children have always grown up to teach us. We begin as their teachers, but the exchange of roles is inevitable.

Earlier we raised the possibility that, through a process of neuron-by-neuron replacement of a human organic brain with an artificial one, it might one day be possible to extend human life indefinitely. And so let me conclude by observing that, if such technological possibilities were to become a reality in our lifetimes, then the speculative questions we have asked might turn out to be relevant not only to our future offspring, whether natural or artificial, but also to ourselves.[32]

32. The author wishes to thank Robert Geraci, Keith Lohse, and Diane Hardin for their helpful comments on an earlier draft of this paper.