THE IMAGE OF GOD AS *TECHNO SAPIENS*

by Antje Jackelén

Abstract. Suppose there comes a day when *Homo sapiens* has evolved into or been overtaken by *techno sapiens*. Will it then still make sense to speak of human beings as created in the image of God? What is the relevance of asking such a question today? I offer a sketch of the present state of development and discussion in artificial intelligence (AI) and artificial life (AL) and discuss some implications for the human condition. Taking into account both reality and fiction in AI and AL, I hold that, regardless of the degree of realization, issues related to technological evolution inform the cultural agenda—at least the European-American one. I comment on antireductionist arguments and on arguments from philosophy and (history of) culture. I argue in favor of a consonance between neurotechnology and the Christian gospel in terms of realizing the marks of messianic life. However, issues of justice, reason versus nature, and perfection and finitude versus imperfection and immortality call for further illumination. Even though no principal opposition seems to exist between technological evolution and possible interpretations of the concept of the image of God (*imago dei*), a number of significant dissimilarities need to be addressed, such as the differences between technical improvement and forgiveness or transformation and between immortality and resurrection. The role of irregularity, disturbance, and error for creative processes in nature and culture is an exciting topic in science and technology as well as in theology.

Keywords: artificial intelligence (AI); artificial life (AL); culture; death; evolution; image of God; information; neuroprosthesis; neurotechnology; technonature; *techno sapiens*.

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A man falls into an empty swimming pool. The lawn mower he has been driving falls in after him and cuts off his right forearm. Eight years later the man says, "I do not miss my original hand any longer." He has an artificial one. Six microprocessors, a lot of silicon, and a number of electromotors and cables create a prosthesis that feels like a part of his body (Klein 2000, 64).

Where silicon and carbon merge, *Homo sapiens* evolves into *techno sapiens*, and we face a new dawn of human splendor—at least if we choose to listen to some popular scientific writing. In our times, scholars in science and religion are facing a lot of fascinating tasks. The question of the human being has again become one of utmost importance for an interdisciplinary discourse. Suppose silicon-based intelligence became as "natural" as carbon-based intelligence; how should the theological statement of human beings as created in the image of God then be understood? A bold mixture of science and science fiction is connected to these issues. Nevertheless, the ideas that come together with the exploration of future perspectives are relevant also to contemporary anthropological discussion. Hence they deserve some serious reflection, even though the realization of the most audacious ideas may lie in a very distant future indeed.

This article raises three basic questions: Where are we today? Where are we going? What are some of the implications from a theological point of view?

Where Are We Today, and Where Are We Going?

The synthesis of electronics and the human body is not new. Since the 1950s people have been receiving pacemakers. Although this affects the heart, the symbolic center of the human person, there is hardly anything controversial about pacemakers. They are more or less a matter of standard medical procedure. Things may change a bit, however, when it comes to a connection of the spinal marrow and the brain with electronic devices. When machines control functions of the body and of the brain (as, for instance, for people suffering from Parkinson's disease) and brain functions of a paralyzed human being command machines via electrodes, something new has come about. Getting an artificial hip implanted might be experienced as something like having a cane incorporated—a dramatic change for an individual but a minor alteration from the point of view of anthropology. Getting a chip implanted is different. It is a way of merging natural and artificial intelligence in the body itself; "electronic gadgets have stepped up their invasion of the body, and our concept of what it means and even looks like to be human is wide open to debate," says one journalistic voice (Hockenberry 2001).

Artificial Intelligence. Attempts to merge biology and technology in a human being build on research in AI. The goal of AI is twofold: the

development of useful tools that can assist or replace humans in various activities and the general understanding of intelligence. Since the 1940s classical AI (building on sequential algorithms) and connectionist AI (working in terms of networks expressed by differential equations) have been challenged by approaches that try to model artificial life, including automatic evolution based on genetic algorithms. AI has developed from symbolic logic as a normative model through probabilistic reasoning toward hybrid models of commonsense intelligence, thus becoming more biologically realistic (Boden 1998; 1990).

Ambitions of AI are high. A core goal is to build fully intelligent artifacts with cognition, perception, action, learning, creativity, and emotion—all the characteristics of what might be called a human being created in the image of God. In many respects these ambitions are still far from realization. In spite of its anthropomorphic bright red lips and big blue eyes, the robot Kismet at MIT has social intelligence that is still quite rudimentary, although the robot itself is a spectacular achievement. On the other hand, research projects like Project Cyborg 2001,[1] events such as the chess champion Garry Kasparov being beaten by the computer program Deep Blue in 1997, and the success of a music program that is able to create "authentic" new music by composers such as Chopin and Beethoven beg the question of the future of carbon-based human intelligence. Salvific promise or apocalyptic curse—who knows? I grew up with George Orwell's *1984*. Boston computer scientist Ray Kurzweil has given us a new date of this kind. He predicts that in 2029 intercommunication between humans and machines, between nerves and chips, will have become "natural." Machines will claim to be conscious, and their claims will be largely accepted (Kurzweil 1999, 220–24). Some seventy years later, software-based humans will by far outnumber those still using carbon-based neurons. Humans who do not use neural implants will no longer be able to participate meaningfully in dialogues with those who do, who by then will be the vast majority (Kurzweil 1999, 234). Hans Moravec's *Robot: Mere Machine to Transcendent Mind* (1999) is another work that stimulates imagination and speculation.

Although this may sound like science fiction rather than science, scenarios like these raise relevant questions, as is revealed by their presence in popular culture. Whether something like the Kurzweil or Moravec scenario becomes reality in thirty, three hundred, or three thousand years, or whether we are merely seduced by our own metaphors, the power of the idea that it might be possible is already effective—both thrilling and scary. The motion picture *The Matrix* (1999) represents a good example of a dystopia with theological undertones. In this film, the predominance of virtual reality over the corporeal, with the decisive events taking place in cyberspace and bodies that are limited to functioning as batteries, signify some of those elements that are extremely challenging to both human imagination and moral values. The film *AI* (2001), with robot David as main

character, poses the question of what it means to be human. Can a robot love, and can a robot be loved? Can a robot have a sense of history, tradition, and festival? Can robotics become part of human culture, part of humankind? Will discussions about robotics echo the debate of the early sixteenth century about whether the people of the New World were truly human? Will there be an inevitable war between carbon-based intelligence and silicon-based intelligence, or is *Homo sapiens* more likely to embrace *techno sapiens* enthusiastically?

On the theoretical side, basically two types of arguments apply to the discussion of AI and AL.[2] Antireductionists argue that logical operations can be performed apart from the meaning that is inherent in human intelligence;[3] hence AI would not necessarily be intelligent. Furthermore, human brains are designed to fantasize rather than to think logically, and AI will never be able to replace the complexity, intentionality, subtlety, and emotional depth of human intelligence. Moreover, intelligence is a function not just of the brain but of a whole system, including both individual components (nervous system, mind, and body) and collective constituents (physical and social environment). The problem with these kinds of arguments is that we so far know too little about how human consciousness actually works and about the future potential of AI and AL. Consequently, arguments of this sort run the risk of ending up in the god-of-the-gaps ditch.[4] Arguments from philosophy and the history of culture raise a slightly different set of issues. Focusing on the underlying philosophy of mind, they ask whether AI is building on an exclusively Cartesian paradigm. Is AI an expression of the Western mind or a challenge to the Western understanding of humanity? Does it presuppose an understanding of intelligence as a universal category, or can it conceptualize intelligence as a cultural category?

Goals and Applications. There are a number of thrilling practical applications of AI, and the list of research projects currently working on the integration of biologically based and artificial intelligence by creating direct brain-body or brain-computer interfaces is impressive.[5]

One question that arises with the development and application of neuroimplants is, What is the goal of all this? Regarding the question of objectives, there appear to be at least three options. The first and probably least controversial aim is *repairing* what has been broken by accident. The second is compensating for some of the defects humans may be born with, *correcting* nature, so to speak, which is a little more controversial but still widely accepted. The third is represented by a scenario in which the bodies of sick people provide the necessary grounds for experimentation in order to improve healthy people—*improving* or even *overcoming* nature. Will there be a time when it becomes routine to get neurochips implanted in order to reach personal optimization? when *Homo sapiens* will be com-

pleted and finally replaced by *techno sapiens*? It is in this third possibility that utopia and dystopia are most closely intertwined. Whereas visionaries dream of chips that will improve memory and consciousness and of an internet of human minds, critics fear the end of freedom of thought, the end of the human person as an individual, and the dominion of a global mind. For the time being, we are not at the point of realizing the third option. However, its anticipation may be inherent in the thoughts of those who guide actual research projects.

The development of neuroprostheses gives rise to hopes but also to a new realism. On the realistic side, natural nerves will probably long remain superior to their artificial replacements or partners. This perspective is likely to reduce the wildest and boldest expectations to a somewhat more realistic level. Nevertheless, a synthesis in the shape of an electronic improvement of the nervous system seems very attractive. On the hopeful side, electronic cochlear implants in small children who were born deaf might, at least theoretically, cure deafness in forthcoming generations. This may appear to be a very hopeful scenario. It would eventually give sign language the same status as Latin. This prospect, however, is not greeted with enthusiasm by the community of the hearing impaired (Klein 2000, 72, 74). Hence, correcting nature is not as uncontroversial as it might seem at first glance.[6]

Implications from a Theological Point of View

Messianic Dimensions. Generally speaking, it may seem that the world has become too complex for our stone-age brain. The neurochip appears to promise help—a new technosphere. The temptation of such a new world might be hard to resist. If one day a neurochip came close to the capacity of the human brain, then memories, knowledge, and peculiarities—the whole personality, so to speak—could be downloaded to a processor. Conscience could be duplicated and stored. Is this the way to immortality? At least it comes close to what Frank Tipler (1994) launched as his concept of the physics of immortality. Regardless of such speculations, neuroprostheses and neurochips combined with human will seem to fulfill too many of the dreams of the good to be easily dismissed. After all, they tend to realize what marks the messianic age, at least according to the Gospel of Matthew. When John the Baptist was in prison and heard what Jesus was doing, he sent his disciples to ask, "Are you the one [the Messiah] to come, or are we to wait for another?" Jesus answered, "Go and tell John what you hear and see: the blind receive their sight, the lame walk, the deaf hear, the dead are raised and the poor have good news brought to them" (Matthew 11:2–6 NRSV).

In this sense, the development toward *techno sapiens* might very well be regarded as a step toward the kingdom of God. What else could we say

when the lame walk, the blind see, the deaf hear, and the dead are at least virtually alive? So far, the requirements of the Gospel and the aims of technical development seem to be in perfect harmony.

I am more concerned, however, about the last requirement in the Gospel, about good news being brought to the poor. Who is going to benefit from these technological developments, and who is going to pay the price for them? A twenty-five-page popular scientific report (Klein 2000) on these issues mentions that veterans from the Vietnam War have been a good resource in research and development of neuroprostheses. All the experts and scholars who are working with the development and application of neuroprostheses and who are mentioned by name in the text are male. The report presents twelve persons who are living with high-tech electronic devices in their bodies. Eight of these are men, and two are boys; six of these are mentioned by name; two boys and two men are mentioned without their names. All ten males represent successful treatments. Only two of the patients are women. One of them is mentioned by name, and the other is an anonymous Parkinson's patient suffering from depression after treatment with electrodes in her brain. Maybe this is just a coincidence. Maybe it is not.

In any case, we should not stop asking how high-tech science can be pursued without widening the gap between the rich and the poor, and how technological progress can be combined with social justice. Most likely, some will have access to all these new technologies and others will not. At the least, this means an enormous social price to pay for humankind; at most, it might imply that the human species will divide into separate branches.

On these grounds, theologians would be well advised not to categorically reject these developments in a precipitous critique. A number of issues deserve careful consideration, however, and among them are the issues of social justice.

Implications for the Human Species. From a technical point of view, humans are a flawed product of evolution: they must sleep and eat, they forget, they are often wrong, and they fall ill. They die and seem to give up all that intelligence, that knowledge, and those skills that were so hard to acquire, train, and maintain. Should we accept this tremendous wastefulness? Maybe we are about to witness a new version of the debate between Samuel Clarke and Gottfried Wilhelm Leibniz about God as a bad clockmaker (Alexander 1956). It seems that a wise God should have organized human existence in a more efficient way.

As we try to cope with this situation, which is anything but ideal, wouldn't it be good to get a chip or two embedded in our brains, making the *Encyclopedia Britannica*, every dictionary, all the read and unread books on our bookshelves, and all our university libraries a permanent part of our memory

and thinking? Constant access to a tremendous amount of knowledge and of languages—imagine having all this present—would be perfect equipment to help us enter wonderfully informed and learned discussions (unless it is our imperfection and the lacunae in our knowledge that render our discussions really exciting and creative).

Who could resist such a temptation? Who could afford not to take advantage of this option once it became real? The logic seems irresistible: "As robots become free thinkers, the only way humans can compete is to use computers to enhance the human brain," writes Kevin Warwick of the University of Reading in England.[7]

Of course it would be a shame to lose all the wonderful knowledge only because of our biological death. And our body appears to be a very ineffective and hazardous tool for storing so much precious information. From this point of view it is hard to resist development toward post-biological beings. The results look promising: overcoming all the constraints that this package of flesh and blood imposes on our mental abilities and saving much of the enormous cost of health care that is a great problem in so many societies. Why should it be impossible to construct a more perfect human being in the shape of *techno sapiens*, in whom hardware could be replaced and software copied infinitely without any severe losses? As Tipler suggests, the next step in the evolution of intelligent life would be machines that process information. For Tipler and others, the extinction of humanity is the logical consequence of continuous progress (Tipler 1994). We are moving toward a posthuman world. Or could we call anything "human" that no longer had anything to do with the human species as a biological entity?

One may wonder whether theologians have reason to worry about the future of the human species. Some will say no, referring to Jesus' words, "Do not worry about tomorrow. Today's trouble is enough for today" (Matthew 6:34 NRSV). And indeed, this postbiological scenario is about a time very long after tomorrow. Others may claim that the most important things about human life are not the immanent evolution and the end of this evolution, if any; the crux of the matter, rather, should be life itself and not human life in a narrow sense. Furthermore, the definition of life itself, in relation to its biological basis, should be open to reconsideration. We are already used to speaking of the life of nonbiological entities such as stories, books, and musical works. This could prepare the ground for an understanding of postbiological life as life.

It could also be argued that the notion of *person* should be reconsidered in the sense that a person is not necessarily identical with a human being as a biological entity. A living being is not to be equated with its biological origin. In that respect, neither the vision nor the potential reality of a *techno sapiens* would cause any serious theological problems. However, a

substantial rethinking of several theological topics, including interpretations of incarnation, would be required. In a new sense, the old question of *Cur Deus homo?* (Why did God become human? Anselm of Canterbury 1962, 171–288) would become the topic of the day. Moreover, concepts such as freedom, emotion, dignity, and sin would need thorough reinterpretation and reconsideration.

The Goal of Evolution. Biologically, evolution operates by means of mutation, selection, and adaptation. In terms of biology, there are no values attached to these concepts. Very often, however, and fairly uncritically, we tend to attach certain values to evolutionary processes. Thus, we talk in terms of adaptation but often understand it in terms of improvement. This applies especially to the context of human evolution, in which evolution has been understood as the successive development of consciousness, awareness, language, sense of moral responsibility, understanding of truth, beauty, and goodness, freedom to do evil, and spirituality (e.g., Peacocke 1989, 16f.).

When we are discussing prospective technonature, it does not make much sense to speak of natural evolution as opposed to techno evolution, as if evolution had been a completely natural process up to a certain moment in history and then became a process controlled by human technology. It seems more adequate to speak of a complex interaction of natural and technical evolution. Focusing on the relations between nature and technology does more justice to the mode in which things have been working for a very long time, and it prevents us from romanticizing nature and natural origins in a way that renders constructive reasoning about scientific and technological developments extremely difficult.

Science and theology agree that humans are imperfect, defective. But the concepts they build on this common ground differ considerably. Science concludes that human beings are in need of improvement. Theology concludes that human beings are in need of forgiveness and transformation. Science wants to achieve an optimization of information processing; theology aims at holiness, salvation, or *theosis* (a kind of divinization). Science thinks in terms of good and better (in quantifiable terms, not morally); theology thinks in terms of old and new (old creation, new creation). Yet, as always, contrapositions like these tend to be too simplistic. It can be argued that even technonature can offer new prospects of morality, for example in terms of justice. Decisions made by technonature would eliminate much of the injustice caused by human decisions, because every fact would be taken into account and nothing would be simply forgotten; personal preferences or prejudices would be overcome—hence, the promise of another brave new world.

Applied to the question of the goal of evolution, the differences in science and theology converge in two topics: what do we consider the kernel

of human identity, and what is the position of the human species in the chain of evolution? Is the essence of human identity a maximum of information processing or an imperfect composition of multiple elements? Is the human species the climax of evolution or not? Should it be? Furthermore, what we feature as the possible goal of evolution also depends on our cosmology, namely, the position of the human species in the universe. Perhaps we will eventually arrive at the formulation of a second kind of anthropic principle, one that applies to the realm of the microcosmos. Whereas the anthropic principle in cosmology is based on the fine-tuning of cosmological constants, a microcosmic anthropic principle concerning *techno sapiens* would be based on fine-tuning between electronics and the brain.

Immortality, Death, and Resurrection. Biological evolution has already helped to reinterpret the difficult biblical statement that "the wages of sin is death" (Romans 6:23). Figuratively speaking, the notion of the death of our relationship to God as a consequence of sin makes sense. Biologically speaking, rather the opposite seems to be true: God has made biological death the means of God's creating new forms of life (Peacocke 1989, 13–16).

Obviously *techno sapiens* changes the perspective of death even more. At what we might perceive as the goal of development, a gate opens to a special kind of immortality, the preservation of a personality and its history in a medium that is not a human physical body. From the point of view of Christian theology, this poses some problems. We believe in the resurrection of the dead and life everlasting, says the Apostles' Creed (in some versions even the resurrection of the body or the flesh), thus describing a vital part of Christian tradition. Who is going to be resurrected to what, if the major part of history turns out to be posthuman or postbiological? Will uploading and downloading minds replace life, death and resurrection? Will this be the end of the human condition, with all that might imply?

The disappearance or at least the modification of mortality will most likely have fundamental consequences for culture. On the one hand, our entire culture has been understood in terms of the sublimated fear of death (e.g., Bauman 1992). On the other hand, not to die is also a nightmare that has haunted humanity for centuries, as shown by the legend of Ahasuerus, the wandering Jew. The ambiguity with which humans tend to react to imperfection and finitude is fascinating. They try almost everything to avoid both imperfection and finitude, yet many would not want to live without them. With perfection comes boredom, lifelessness, and loss of creativity, whereas the relevance of disturbance and error for constructive developments has been recognized in various areas of knowledge.

Would culture disappear along with finitude and death? What would happen to language if communication took place directly from brain to brain? What would a radical prolonging of the human life span imply? Whose lives would be prolonged or immortal? Probably the rate of replacement of human beings would decrease considerably, or maybe even become zero, unless a massive colonization of space altered the scenario profoundly.

Subsequently, all individuals within a given civilization would become known to each other. Thus, surprise and amazement would cease to be part of human reality, as Hans Jonas pointed out in the 1970s (Jonas [1979] 1984, 47ff.). A substantial prolongation of life "will wreak havoc with most existing age-graded hierarchies" and have dramatic effects on the possibility of social changes (Fukuyama 2002, 64f.). Moreover, "life expectancy" would become more or less meaningless. All understanding of life and death would be affected by a new time parameter. If silicon speeds instead of carbon speeds became the general time parameter, notions of simultaneity and concepts of what a generation or a life span implied would alter radically, or maybe even totally. The consequences of these sweeping changes are hard to foretell.

Variations of the Image of God. What is a human being according to Christian tradition? A famous answer is the one given in the first account of creation in Genesis: "So God created humankind in his image, in the image of God he created them; male and female he created them" (Genesis 1:27 NRSV). From this, theology derived various interpretations of what it means to be *imago dei*, a divine image. Anthropomorphic interpretations such as walking upright as well as the etymological explanation of *anthropos* as being turned upward have been replaced by less corporeal interpretations, such as morality, rationality, and self-consciousness. Consequently, embodiment became more or less a nonissue in interpreting the *imago dei*. This development, however, has been criticized for a number of reasons—as mirroring a patriarchal system, as sacrificing women and nature on the altar of reason, and as denying the biological unity of humans with the rest of nature (e.g., Merchant [1980] 1989). Hence, static concepts of *image* have been reinterpreted in terms of the process of imaging. The focus has shifted from what distinguishes humans as created in God's image in relation to the rest of nature toward an exploration of what it is that enables human beings' imaging God in communion with the rest of nature (e.g., Page 1996). From this perspective, recent developments in theology seem to point in a direction that runs counter to AI: on the one hand, a new closeness to corporeality, on the other hand, an artificiality that tries to transcend nature.

Yet, as a long tradition of noncorporeal imaging of God shows, biological reality does not necessarily have to be a feature of Godlikeness. Again, there is no principal theological reason to denounce the development of *techno sapiens* altogether.

A good candidate for a fruitful discussion from both theological and technological perspectives is the question of relationality. Relationality can be addressed as a crucial feature of the image of God, and it certainly is also an issue relating to AI and its various applications. In my view, relational capacity and a creativity that goes together with—and often results from—imperfection are crucial marks of the image of God. The second trait especially, imperfection, does not fit well with an understanding of God as primarily omnipotent and omniscient. But it fits with the image of a God who creates by means of irregularity, instability, disturbance, and sudden inflation—features we recognize from the epic of creation as it is told by contemporary science. Such an understanding is also consonant with the image of a God whose primary interest is not in determining the initial conditions but in luring the world into its eschatological future (cf. Haught 2000).

Christian theological anthropology has used the building blocks offered by tradition in various ways. Eastern orthodox tradition usually emphasizes that anthropology has to be understood from the vision of the glorified incarnated God. It is the risen Christ who is the point of reference for a proper understanding of the human being. Thus, although distorted, the human being always remains an icon, a true divine image. Western tradition has paid closer attention to the distortion of the original God-likeness and developed various concepts of restoring what has been demolished. That is why both the concept of salvation by grace and the idea of improving oneself and the world are inherent in classical Western interpretations of being the image of God. Especially in Protestant tradition, personal responsibility has been emphasized. Individuals are expected to make moral and ethical decisions assisted by the Bible and the Christian community as well as by their conscience and intellect. Consequently, Philip Hefner has taught us to look on the human being as a created co-creator (Hefner 1993).

But how can we see the image of God in *techno sapiens*? If development goes from *Homo sapiens* to *techno sapiens*, is there a point where the created co-creator turns into a self-designed engineer? Will the created co-creator lose identity because the self-understanding of being created disappears and the broad notion of creativity is narrowed down to technological creativity only? Or is there a point where the created co-creator as a cyborg turns into something operated by remote control? I guess what is at stake here is the dimension of that which is not at the entire disposal of human beings. Do we accept that there should be something not at the disposal of human beings/ of nature/ of culture? If yes, how do we define that which is not at their disposal, and what kind of value do we attribute to it?[8] Who owns our bodies, tissues, cells, and genes, and who will own what, if or when *Homo sapiens* is succeeded by *techno sapiens*?

If we take seriously relationality as a mark of human existence, the human person is not fully explained as merely a homogeneous entity of genes or a biological unit with mental capacities. To describe human identity we also have to consider different ways and spheres of human relationships to various aspects of reality. A possible description, taking into account some of these dimensions, would be to portray the human person as *Homo liturgicus*, *Homo faber*, and *Homo ludens*, thus calling attention to the human dimensions of ritual, Promethean creativity, and play. *Homo liturgicus* comes close to the ideal person in Eastern Orthodox tradition. He or she is surrounded by a certain mystification: the priest prays beyond the iconostasis, concealed from the laity; there are symbols that are not easily understood, and there is a sacred language that nowadays is far from everyday language. In regard to the aim of *Homo liturgicus,* Eastern anthropology is firmly embedded in the concept of *theosis* (divinization). Western Christian anthropology, by contrast, often emphasizes the radical difference between God and humans. The ideal person in the West is not *Homo liturgicus* but *Homo faber*, the craftsperson, one fascinated by the use of tools who has an engineer's approach to life rather than a mystic's approach. Here, the center of the liturgical agenda is not the mysterious and the concealed but the *kerygma*, the clarifying proclamation of the gospel. Now, as Max Frisch has shown, *Homo faber* is a tragic figure (Frisch [1957] 1977), at least as long as *Homo faber* is not completed or fulfilled by *Homo ludens*, the playing human (Huizinga 1940). *Homo faber* remains a tragedy as long as she does not find herself as *Homo ludens*, a playing being, be it the play of secular games, the play of music and art, or the sacred play of holy liturgy.

These are only three examples. Others could be added to this picture of anthropological complexity. But what has been said is enough to raise the question: How can *techno sapiens* ever achieve an integration of such different dimensions of what it means to be a human being? How would he or she do it? Is the *techno sapiens* approach necessarily a reductionist one? Or the other way around: Can *techno sapiens* do justice to a complexity that *Homo sapiens* strives to achieve but all too often fails to realize?

Finally, all anthropology has to face the question of its own situatedness. What kind of perspective do we choose for our anthropology—an innerworldly one or a cosmic one? It seems to me that today there is too great a gap between those who deal with the universe and those who deal with anthropology, whether in biology, medicine, philosophy, or theology. Many anthropological discourses do not sufficiently question their own anthropocentric or geocentric point of departure. To go beyond this narrow basis seems to me a good first step toward preparing the soil for a fruitful discourse concerning all those issues that arise with the step-by-step creation of *techno sapiens*.

I have mentioned here some facts and visions emerging from research in AI and neurotechnology and have looked at some of the anthropological issues they bring up. I have mostly asked questions rather than given answers. I think this is a necessary approach to a scenario that deals with the future we seem to be bringing about, a future that a relatively small group of people are trying to bring about but that would affect the vast majority of people. Raising the issues is a good way to provide fuel for discussion and reflection. Being clear about questions is an important step. But we will have to reach much further than that.

Notes

1. The project is directed by Kevin Warwick at the University of Reading, U.K., *www.cyber.redg.ac.uk.*
2. Apart from applications "regarding computer viruses, biomorphs and ontogenetically realistic processes, autocatalytic nets, cellular automata, and artificial nucleotides" (Meyer 1996, 326), research in AL has been especially concerned with the construction of "animats," that is, animals simulated by computers or by actual robots. For a presentation of definition, goal, and methods, see Meyer 1996.
3. See the discussion of the Chinese-room argument introduced by John Searle in Penrose [1989] 1999 and Boden 1990.
4. Roger Penrose ([1989] 1999, 578ff.) tries to take a middle path. He holds that any purely computational understanding will not be able to explain consciousness, because the conscious mind cannot work like a computer. Yet mathematics is a preferred way of gaining knowledge about the mind. The "gap" is not supranatural; it exists because computability is not the same as mathematical precision.
5. See, for example, the Web site of the Neuroprosthesis Research Organization, *http://www.neuroprosthesis.org/project.htm.*
6. For further information on possibilities and problems of bioengineering and microelectronics see the section on "Bodybuilding: The Bionic Human," *Science* 295 (8 February 2002): 995–1033.
7. *http://www.cnn.com/2000/TECH/computing/12/07/robot.man/index.html.* Warwick's experiments with computer chips in his own body have attracted a lot of attention.
8. For an attempt to build an answer to these questions on a concept of human nature and human dignity see Fukuyama 2002.

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