European Journal of Science and Theology, June 2014, Vol.10, No.3, 15-26

THINKING OF ARTIFICIAL INTELLIGENCE CYBORGIZATION WITH A BIBLICAL PERSPECTIVE (ANTHROPOLOGY OF THE OLD TESTAMENT)

Seung Ho Bang*

Baylor University, Department of Religion, One Bear Place #97284, Waco, TX 76798, USA

(Received 26 August 2013, revised 17 September 2013)

Abstract

What percentages of original human organs in a human body constitute a human as an authentic human being? In other words, if we have the ability to manipulate our level of bodily augmentation by substituting original body parts with artificial organs, what is the threshold for keeping our genuine human nature? It is an important question since Artificial Intelligence (AI) includes futuristic terms such as cyborgs and augmented humans with artificial organs, and current biomedical technologies allow us some degree of augmentations. Therefore, an assessment of cyborgization in conjunction with Christian ethics and Theology is not futuristic, but is, perhaps, late. An attempt to bring cyborgization to the table of the proper theological discussion should be begun with an anthropological view from the Old Testament (OT) because the OT covers human nature within the framework of the creation. More particularly, OT anthropology provides some starting points for considering AI as a phenomenon of human life given by God that has sanctity not only at the moment of procreation and death, but also in the course of a life span. OT anthropology also informs us that cyborgization for either therapy or augmentation should be used prudentially as the God given gift of Science has two edges. Finally, since we cannot define what the intended purpose of God's creation means, Anthropology further instructs us in the importance of a conversational approach to uncharted territory.

Keywords: cyborg, augmentation, creation, Old Testament anthropology, biomedical technology

1. Introduction

Are you sick and tired of learning foreign languages and plowing through an ever-increasing reading list? In the near future, we may face a new era that requires neither foreign language learning nor extensive reading. As we become posthuman, that is beings whose physiological capacities are enhanced by the means of synthetic artificial intelligences and/or biomedical engineering, all the data will be implanted into our cyber brains. In fact, in recent decades we have

* E-mail: Seung_Bang@baylor.edu

seen increased examples of technological intervention of the human body; cyborgs are here and now [1, 2]. Therefore, thinking about Artificial Intelligence from a biblical perspective is not an option but imperative. While scientists have already begun to talk about the rights of people who have been the subject of technological intervention from an instrumentalist perspective [1, 3-7], religious communities seem to be reluctant to respond to the new technologies that blur the definition of what it means to be a human being. Therefore, my purpose in this paper is to provide a view of cyborgization — the process that produces augmented human beings — from a biblical perspective. Particularly, OT anthropology is a proper place to begin with the discussion of the currently uncharted cyborgization issue with ethical and theological considerations because OT anthropology asks the ontological questions of the human beings and their distinct nature: how we came to exist, who we are, and what is the purpose of our existence. Most of all, all these questions begin with Creation, God's sovereign territory, which we are inherit some parts and exercise in our daily life. This study, however, is not an attempt to present a fully formed theological manifesto. Rather, the aim is like forerunner of AI research venue Kevin Warwick's attempt to open up the discussion, but from OT anthropological perspective [8].

2. Definition of AI

AI is a field of Computer science that "studies the synthesis and analysis of computational agents that act intelligently" [9]. Among numerous definitions of AI, the one that describes AI as "intelligent machines that achieve goals by computations" [J. McCarthy, *What Is Artificial Intelligence?*, 2007, online at http://www-formal.stanford.edu/jmc/whatisai/whatisai.html] stands out as the most relevant description that helps us approach the phenomenon of human augmentation by artificial means. In a broad sense, AI can include cyborgs. 'Cyborg' a term that often connotes negative unity between a machine and a living being with a dystopian view of an uncertain future, more precisely means a 'cybernetic organism' that controls human-designed processes through feedback and response in relation to human augmentation [1, 10].The term 'cybernetics' with the abovementioned notion was first coined by Norbert Wiener in 1948. In his book, the term originally indicates "the entire field of control and communication theory, whether in machine or in the animal" [11]. A cyborg, however, also refers to an enhanced human being by means of mechanical, electronic, and/or bionic implant parts. A 1973 novel called 'Cyborg', which gave rise to two television series, 'The Six Million Dollar Man' and 'The Bionic Woman' are good examples of a cyborg [1, 6].We are familiar with AI and cyborgs but most have not seen such in our daily grind. Or have we? In a technical sense, cyborgs are no longer futuristic creatures. Some scientists expand the notion of cyborg and claim that cyborgs already exist within our society [12, 13]. These cyborgs include people who have implanted electronic pacemakers, artificial joints, corneal lenses, and artificial skin. Therefore, it is

necessary to specify cyborgs in terms of the purpose of cyborgization. Roger Clarke's classification is instrumental in this regard; the following is his classification and definitions [1].

On the one hand, "Prosthesis or Prosthetic is an artifact that provides the human body with previously missing functionality or overcomes defective functionality" [1]. From the instrumentalist purpose, Clarke excludes cosmetic or ornamental artifacts (e.g. glass eyes or breast implants). Prosthesis is further divided into three sub-categories depending on its implanted location of the human body. *Endo-Prosthesis* is 'a prosthesis internal to the human body and interfaced with it' (e.g. artificial hips and knees, stents, pacemakers, cochlear implants, and implanted lenses). *Exo-Prosthesis* is 'a prosthesis on an outer extremity of the human body and interfaced with it' (e.g. contact lenses, artificial hands, arms and legs).*External Prosthesis* is 'a prosthesis separated from the human body, but interfaced with it' (e.g. walking sticks, crutches, renal dialysis and heart-lung machines). On the other hand, *Orthosis or Orthotic* is 'an artifact that supplements or extends a human's capabilities'. *Orthosis* also can be sub-divided into *Endo, Exo,* and *External Orthosis*. The purpose and functions of Prosthesis and Orthosis distinguish one from another. For example, "an artifact that assists in the recovery of normal sight is a prosthesis, one that provides 'sight' beyond the normal human visible spectrum is an orthosis" [1, p. 51]. These two different concepts help us to define a cyborg "as a person whose physiological functioning is aided by **or** [sic] dependent upon a mechanical or electronic device" [1, p. 52]. Simply put, *cyborg* is "a human with either a prosthesis or an orthosisor both" [1, p. 52]. In this paper, I consider AI as a broad umbrella term that encompasses both kinds of cyborgs, prostheses and orthoses with a limited sense, and a fully self-functioning android.

3. The current technologies for artificial brain part implantations

For several decades, masterpieces of Sci-Fi literature throughout the world have depicted the 21st century as an era of AI's domination. To name a few, Isaac Asimov's *I, Robot* [3], Philip Dick's *Do Androids Dream of Electric Sheep?* [14] and Masamune Shirow's *Ghost in the Shell* [15] are three exemplars. Although these Sci-Fi literatures are too futuristic, we're, in fact, living in their future. So, it is necessary to review modern bio-medical technologies related to the development of AI in order to get a sense: what biomedical technologies do we have in our hands and what we can do in the near future with the technologies. Ever since a wearable artificial kidney was invented in 1979 [16], developing artificial organs dramatically advanced. Actually, the need for artificial organs has been exponentially increasing as a means of temporary and permanent therapy for patients [17]. Not only did the need begin to become prominent for therapy purposes but experimentation in enhancement/augmentation such as implanting artificial organs or other body parts has become more common because with implanted artificial organs we believe we can improve our ability. In 2004, Warwick insisted, "by linking the

human brain to a computer we could gain improved communication, memory, mathematical ability and extra sensory capabilities which would make the person intellectually superior" [12, p. 47]. In fact, Warwick himself was an example as he had an array of 100 electrodes implanted into the median nerve fiber of his left arm that were then wired to an external computer in order to link himself to the Internet for a few months [18, 19]. With this implantation, Warwick was able to control a wheelchair, to articulate an intelligent artificial hand [K. Warwick, *The Next Step towards True Cyborgs?*, 2011, online at http://www.kevinwarwick.com/cyborg2.htm; 19], and to extend human sensory capabilities [20]. Noteworthy is that he was able to control a robot arm in the University of Reading from Columbia University in the U.S. and received feedback through the Internet [D. Heide, *The Cyborg Scientist*, Physics Central, 2013, online at http://www.physicscentral.com/explore/action/project-cyborg.cfm].The results of this experiment seem to be rudimentary. Thus, we may not deem Warwick as a 'person intellectually superior', but, what we should take from this experiment is an indication of what we can do right now.

Here, the possibility of implanting an artificial (part of) brain can be asked both for therapy and augmentation. Currently available or developing technologies are (1) an artificial hippocampus, which will perform the same processes as a damaged part of the brain and replace a damaged brain due to stroke, epilepsy, or Alzheimer's disease [D. Graham-Rowe, New Scientist, 2003, online at http://www.newscientist.com/article/dn3488-worlds-first-brain-prosthesis-revealed.html]; (2) Deep Brain Stimulation (DBS), which will treat tremor, dystonia, and pain by an implanted neurostimulator connected to deep brain using electrodes in the thalamus, sub-thalamus, or globus pallidus [21]; (3) an implantable Brain-Computer Interfaces (BCI), which will allow physically disabled people to control various devices using their thoughts [K. Lampka, Business Wire, 2005, http://www.businesswire.com/news/home/20050224005164/en/Six-Month-Results-Cyberkinetics-BrainGate-Neural-Interface-System]; and (4) a biological brain made up of human neurons [8]. These biomedical technologies, particularly BCIs, suggest that people with severe disabilities may be able to use their brain signals to operate and/or control specific parts of an artificial body such as, a robotic arm or a neuroprosthesis, or that damaged brains can be replaced by artificial ones. The experiments of cyborg insects have already well proven the feasibility of another way of using BCIs — namely, a computer controlled physical body or body parts of an insect. In 2009, an experiment of a radio-controlled cyborg beetle in free-flight was successfully done and out performed the mobility of man-made micro air vehicles [22].

Not only in cyborg insect study, but also in the medical field, replaceable human body parts are quickly developing. In 2007, the Scottish company Touch Bionics launched the first commercially available bionic hand: the i-Limb Hand that looks and acts like a real human hand. By May 2010, they had sold it to more than 1,200 patients worldwide [23]. Another good example is Proto 2, initiated by the Defense Advanced Research Projects Agency. This artificial

limb hand is a thought-controlled mechanical arm–complete with hand and articulated fingers that can perform 25 joint motions [23]. All of these studies attest to the fact that current biomedical technology is able to do cyborgization – making a human life dependent on artificial intelligent human body parts as a means of therapy or to enhance human beings' natural abilities or even to overcome limitations by way of augmentation.

4. State of the questions

Why does it matter if we have implanted artificial body parts as long as we do not completely replace our brain with a cyber brain? It is because a body is an important constituent for our thoughts, feelings, and actions [24, 25].Frank Biocca insists, "at the center of all communications rests the body" as "the senses are the portals to the mind" [24, p. 13]. If "the body is integrated with the mind as a representational system" or "thought is embodied or modeled by the body" [24, p. 13], many questions arise regarding implanting artificial body parts [26]. Would we regard cyborgs' thoughts and feelings in the same way as ones of conscious living beings? Should a person with an artificial brain or a genetically produced organic brain be regarded as human being? Should a person who is incased in the machine be considered as AI or a human being? Even further, we can ask what makes a person human? All these questions merge at this one point: What makes human beings distinct from AI?

Nevertheless, these questions seem to be philosophical and hypothetical. So, let's deal with real issues that we can find today. Case studies in cyborgization and rights by Clarke in 2010 are noteworthy in this regard [6]. The first case is in sport. A controversy over Oscar Pistorius' eligibility for the international competition would be the best example; i.e. the rising issue of "an unfair advantage to orthots over able-bodied athletes" [6, p. 15]. The second case is comprised of constraints on cyborgized humans because they can be perceived as "unnatural, 'playing God,'… violating principles and laws relating to human dignity, human inviolability, human autonomy and self-determination" [6, p. 16]. The European Union's opinion on cyborgization [27] substantiates this view as it approves on prostheses but disapproves orthoses other than those that improve health prospects [6, p. 16]. The third case is in the effort of developing anthropo-supremacist, which intends to achieve the same ends as eugenic [6, p. 16]. The military, national security, and law enforcement fields can be examples of the emergence of anthropo-supremacist because personals in those fields commonly use weapons (external orthoses) and protective suits (exo-orthoses) [6, p. 17].

5. Biblical perspective on cyborgization

To examine the cyborgization phenomenon from OT anthropological perspective, the following questions would be helpful: (1) what are the differences between humans and AI in terms of life, death, and the value of

life?, (2) where should the boundary be drawn for the limit of our creativity?, and (3) how do we use technology in the fulfillment of our life? To precede the arguments, I'd like to exclude cyborgized humans from AI temporarily, but AI only refers to fully self-functioning mechanisms in the rest of this paper. The reason for this exclusion is because it is not only difficult to talk about moral status and civil rights for those who have gone through cyborgization presently, but also the ultimate aim of the effort of cyborgization would end up like the 2045 *initiative*, which "aims to create an Avatar with an artificial brain in which a human personality is transferred at the end of one's life" [The 2045 Initiation, 2013, online at http://www.2045.com/]. In the proceeding arguments, however, I will try to bridge to think of cyborgized humans by considering the abovementioned questions on AI.

5.1. Life and death vs. duration and termination?

When thinking of AI, we must first delineate that which makes a human being distinct from other forms of life. A typical Christian perspective on human life understands life as a sort of divine loan that requires respectful stewardship [28]. We have to consider this divine-loan within a constrained time frame in light of the relationship with God. For example, interpreting Genesis creation account, Han Wolff maintains, "the powerful anthropomorphism stresses that [humans] receive [their] form and life from God" [29]. Divine power-sharing with the creature is revealed in divine blessing that enables humans to fulfill their responsibilities [30]. Therefore, God's relationship to humanity is the presupposition for humanity's self-understanding. This relationship makes human life an object that has divinely given sanctity rather than value. In contrast to this idea could be the various forms of *life* wrapped up in artificial machines, which is designed by humans or other sentient beings for the purposes of specific functions. Thus, when an AI has a distinct function, the AI could be regarded as one that has value, not sanctity.

To speak of the distinctness of human life, one must consider death next. Death is distinctly different for humanity and machines. Humans die as machines are destroyed, terminated, or go out-of-service. This undeniable fact makes every human being fear of death. Does AI fear death? Since AI as an industrial product could extend its span of functioning duration by proper maintenances of its system and regular replacements of malfunctioned mechanical parts, it is hardly conceivable that AI has the same concept of 'fear of death' that humans tend to have. In a sense, the only case that machines die is when they no longer have value or efficiency to be maintained: it is the nature of technology industry that there will be always better and cheaper replaceable machines soon or later. Furthermore, it seems hard to develop the meaning of death in terms of a relational perspective for AI other than an instrumentalist one. OT represents a relational concept of death: "when [a human] is beyond the possibility of praising God, [one] is 'in death'" [29, p. 111]. Consequently, what makes human beings different from AI is the virtue of awareness of both

physical and spiritual death. Nevertheless, like the matter of life, death as the criterion cannot be easily applied to those who are cyborgized, particularly those with cyborgized brain parts. If someone has an artificial medulla and encounters a fatal mechanical failure that causes the person to experience somatic death due to lack of breathing, but the person is resuscitated by implanting a new part of the brain, then which part of the person's body experienced death? Will the person's death be a matter of an 'on and off' signal from the artificial medulla? Should the person's life be regarded as termination or a subject to be maintained? Answering these questions is difficult not because of the unfamiliarity of the augmented human beings or the life in machine, but because of the sanctity of human life.

5.2. A creation within the creation vs. a creation outside of the creation?

One of the popular topics in conversations that are concerned with the issues of Biomedical ethics and Theology is whether we possess the right to create a form of life, which is the distinct sovereignty of God. To review our right of creation, the first place to begin would be the question; whether our creative activity, especially in dealing with life (either prolonging life or producing a form of life) is within or outside of God's creative jurisdiction.

Indeed, there is nothing wrong with the creative activities of human beings as the practicing of a gift from God. The problem with developing AI, however, is that it may violate two premises in God's creation: (1) the purpose of humanity and (2) the *Imago Dei*. The development of AI could be more than a mimicking of God's creative activity. Rather, it could dismantle the purpose of God's creation of humanity. God creates humanity in his image and likeness, and these privileges are maintained in his power-sharing relationship. Therefore, we are naturally given God's creative power [30, p. 48].Since the created world is not static or perfect, this state requires humans' responsibility — working creatively with the disorder for the purpose of the eventual completion of the creation [30, p. 9, 44, 125, 276]. But, our creative works would be an *intra*-creational development, creation within God's creation. The best example of God's power-sharing relationship can be found in Genesis 2.19-20a. In this creation account, the man gave names to all things that *God created* and brought to him. In the scene, naming has a crucial function as it carries the same creative power as the one that God used in creating the world with his words [30, p. 58-60; 31; 32]. But, the man's exercising of his creativity held within the bounds of God's creation [33].

This limitation of our *intra*-creative power should be viewed in terms of the relational perspective and the image sharing with God. We can approach this supposition through a covenantal relationship with God and other fellow humans and the importance of *Imago Dei.* Karl Barth remarked that human beings are in a covenantal relationship with God [34]. This relationship has begun even before God created mankind. God's creation of human beings is not accidental but a premeditated and deliberate action for the purpose of

relationship. Since humans are created for intimate relationship, it is human nature to seek to have a co-respondent [35, 36]. Simply put, human beings are created as social and communal beings. God's creation of Eve for Adam can be seen in this way too [31, 37]. If we develop AI to substitute for relationships with others or for our relationship with God, such would seem to be an unfortunate choice [35, p. 93]. Making autonomous beings according to our images and likeness, which bears *Imago Dei*, would destroy the intended relationship with God and with other fellow humans. Furthermore, in efforts of *extra*-creation, we are, in fact, mimicking God's creation based on *imago hominis* [35, p. 33-52]. Gerhard von Rad argues, "the purpose of this image of God in man, that is, the function committed to man in virtue of it, namely, his status as lord in the world" [38]. Nonetheless, misunderstanding our abilities and setting ourselves up as ultimate ruler might put us in danger. Therefore, Hans Wolff warns that "the subjection of the world must not lead to man's being dominated by a myth of technology, which produces the technically possible simply because it *is* possible, and therefore subjects man to technological and economic compulsion" [29, p. 164]. Therefore, all the creative power that God entrusts to human beings ought to be exercised within a matrix of relationship to God [30, p. 59].

5.3. A human dependent on an artificial part vs. an artificial part dependent on a human

Lastly, we should begin to ask whether implanting artificial body parts is to be helpful for fulfilling our life. In the creation account in Genesis 1.28, God commands us: "Be fruitful and multiply, and fill the earth and subdue it; and have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth" (NRSV).

In this command of God,) רדהdominion) should be considered for our discussion. A study of the word 'dominion' reveals that "it must be understood in terms of care-giving, even nurturing, but not exploitation" [30, p. 48-49; 37, p. 529; 39-41] *contra.* Milgrom argues that the verb denotes absolute control over the animal kingdom [42]. In the Hebrew Bible, evitagen htob syevnoc רדהand positive connotations depending on who the subject of the verb is. On the one hand, when the subjects of the verb are humans, הדר usually means exploitation by exercising power over lesser parties. A series of apoditic prohibitions of this kind of exploitation in the book of Leviticus is a paradigmatic example. In Leviticus 25.43, 46, 53, we are told that one shall not rule over others with harshness and/or severity. Following David Daube, Jacob Milgrom interprets these verses as God's divine intervention connected to the redemption from Egypt. That is to say that life of Israelites belongs to God as his servant and no one is obligated to serve others. The meaning of the verses in the broad context is that of a legal prohibition could be related to the Jubilee for oppressed [43]. The threefold repetition emphasizes the prohibition as a very significant matter [42, p. 2239] and as a presupposition of the Jubilee. We can expand this notion

of the Jubilee as emancipation from the chaotic state and returning to the divinely ordered state. On the other hand, when the subjects of the verb are God or his heavenly host, רדה can mean to rule over enemies (Psalms 72.8, 110.2, Joel 4.13) through which the divine order is established. In these verses, הדרis used in the jussive and imperative forms. From this observation, we can draw a tentative meaning of הדר in which God is the subject of the verb and this brings about an ordered state. In fact, the same forms of the verb, jussive and imperative, are used in Genesis 1.26 and 28; among all 24 occurrences of the verb, jussive and imperative forms are used only for God and his heavenly host with the exception of Genesis 1.26 and 28. Consequently, the verb reveals God's determination of sharing his divine power that can bring stability to the world, the state of divine *shalom* and harmony among his creation with humanity's participation.

It is interesting to note that both Genesis 1.26 and 28 have the fish of the sea as the first objects of the verb. In the ancient Near Eastern contexts, a characteristic depiction of primordial water as chaos was prevalent. In the Old Testament, we can find multiple instances in which God establishes order by conquering the primordial water. Psalm 72.8 is one of the example that actually uses the same verb, ,רדה appeared in Genesis 1.26 and 28. This is not to say that God's created world lacks order or in a chaotic state. Rather, as we discussed above, the world needs completion. This meaning of the word would suggest a model of the measurement of therapy and augmentation by any artificial means. Artificial objects could be used to increase our ability and efficiency in nurturing the Earth. When the subject and object is switched, however, it becomes problematic. For example, if human beings pursue the achievement of the perfection of the human body, immortality, or the development of the perfect android, human beings may eventually become subordinated to the technology, like the infamous *Terminator* nightmare. An adequate development and application of technology is well addressed in *Congregation for the Doctrine of the Faith* that technology "must be at service of the human person, of his inalienable rights, and his true and integral good according to the design and will of God" [44]. Therefore, on the one hand, whenever human beings are bound in covenantal relationship with God, the use of technology or a person dependent on artificial means, could be beneficial in helping humanity to fulfill the command of God. On the other hand, whenever human beings are bound to a faith that technology eventually will deliver humanity from the fear of death and propel humanity to overcome its natural limitations, the use of technology could be maleficent because faith in technology will enslave human beings to a nihilistic false hope.

6. Conclusions

Already in the announcement of the 2005 annual conference for the American Society for Artificial Internal Organs, tissue engineer Michael Lysaght said "about 2.5 million patients a year receive a human-designed spare

part. The impact of artificial or bionic spare parts is so important to American medicine that it accounts for 1% of the U.S. Gross Product." [American Society for Artificial Internal Organ. Asaio News, Asaio 51st Annual Conference, 2005] Therefore, the American Society for Artificial Internal Organs remarks that the 21st century is the emergence of the bionic human, or "a living being supplemented by artificial organs". Furthermore, some scientists speculate that sometime around 2030 or 2040, computer technology may replace our species or that humanity might become part of machines leading to immortality [35, p. 81, 69-77].

It is unfortunate that cyborgs as part of the AI phenomenon have not been seriously discussed in theological circles thus far. As we have observed, cyborgization is becoming popular and might trace its conceptual roots to the desire for optimum performance and to overcome the fear of death by way of modern biomedical technology. Nevertheless, it must be emphasized that the mystery of life does not lie in optimum performance, rather in uncertainty. Thus, if scientists attempt to control and improve humanity's performance to an optimal level by developing artificial organs, this act can be considered to be absolutely contrary to how life functions. In the end, the ultimate aim of this race would end up attempting to achieve immortality like the 2045 *Initiative.* If technology takes us to a new horizon of life, is it one at which God originally intends us to be? Or is it empty futility? In fact, we, as human beings, may not able to properly assess AI because we are not AI. In order to have a fair perspective on this phenomenon we need input from those who have already gone through some degree of augmentation. Yet, we may have an introductory response to cyborgization: (1) Human life, in both corporeal and spiritual dimensions as a psychosomatic unity, given by God has sanctity not only at the moment of procreation and death, but also in the course of a life span. During this course of life, we often overcome our physical and/or mental limitations and fulfill self-realization with or without artificial means of help. This human spirit makes human life sacred. (2) Cyborgization, for either therapy or augmentation, should be used prudentially as a God given gift of science that has two edges. If the science is used to bring the fullest potential of God's creation, it is recommendable. When Science is used to distort and/or disrupt the purpose of God's creation and its eventual completion, the use of the technology should be cautious. (3) Since we cannot define what the intended purpose of God's creation and the state of the eventual completion mean, we should be conversational about uncharted territory such as (a) those with an implanted artificial intelligence organ into the brain, (b) those who only have an original brain but are fully immersed into a mechanical body or vice versa, and (c) those who are fully self-functioning machine — stand-alone androids.

Acknowledgement

My thanks to Baylor University graduate colleague, B.J. Parker, for reading earlier drafts of this article, which was presented at the Annual Regional

Meeting of American Academy of Religion at Southwest Commission on Religious Studies in Irving, TX on 10 March 2013, and offering invaluable feedback. I would also like to thank Dr. Allen Redmon, the session chair of AAR: arts, literature, and religion, and other participants in the session for their valuable feedback.

References

[1] R. Clarke, IEEE Technol. Soc. Mag., **30** (2011) 49-57.
[2] A. Toffler, *Future Shock*, Random House, New York, 1970, 193-199.
[3] I. Asimov, *I, Robot*, Gnome Press, New York, 1950, 33-51.
[4] R. Clarke, Computer, **26(12)** (1993) 53-61.
[5] R. Clarke, Computer, **27(1)** (1994) 57-66.
[6] R. Clarke, *Cyborg Rights*, Proc. of 2010 IEEE International Symposium on Technology and Society (ISTAS), IEEE, New South Wales, 2010, 9-22.
[7] B.-J. Koops, M. Hidebrandt and D.-O. Jaquet-Chiffelle, Minn. J. L. Sci. & Tech., **11(2)** (2010) 497-561.
[8] K. Warwick, *Experiments into Biology-Technology Interaction*, Proc. of 2011 XXIII International Symposium on Information, Communication and Automation Technologies (ICAT), IEEE, Sarajevo, 2011, 1-5.
[9] D. Poole and A. Mackworth, *Artificial Intelligence: Foundations of Computer Agents*, Cambridge University Press, Cambridge, 2010, 3.
[10] D.J. Haraway, *Simians,Cyborgs, and Women: the Reinvention of Nature*, Routledge, New York, 1991, 149.
[11] N. Wiener, *Cybernetics, or, Control and Communication in the Animal and in the Machine*, Wiley, New York, 1948, 11.
[12] A. Hardy, Comput. Control. Eng. J., **15(3)** (2004) 47-47.
[13] K. Hayles, *The Life Cycle of Cyborgs: Writing the Posthuman*, in *The Cyborg Handbook*, H.G. Figuroa-Sarriera, C. Habels & S. Mentor (eds.), Routledge, New York, 1996, 321-338.
[14] P.K. Dick, *Do Androids Dream of Electric Sheep?*, 1st edn., Doubleday, Garden City, 1968.
[15] M. Shirow, *The Ghost in the Shell*, Dark House, New York, 1995.
[16] T. Agishi, J. Artif. Organs, **36(12)** (2012) 1012-1014.
[17] Y. Mitamura and H. Nishida, J. Artif. Organs, **4(3)** (2001) 169-171.
[18] C. Evans-Pughe, IEEE Review, **49(5)** (2003) 30-33.
[19] K. Warwick, M. Gasson, B. Hutt, I. Goodhew, P. Kyberd, B. Andrews, P. Teddy, and A. Shad, Arch. Neurol., **60(10)** (2003) 1369-1373, online at ftp://ftp.cordis.europa.eu/pub/ist/docs/dir_f/ws5_9.pdf.
[20] K. Warwick, M. Gasson, B. Hutt, and I. Goodhew, *An attempt to extend human sensory capabilities by means of implant technology*, Proc. of 2005 IEEE International Conference on Systems, Man and Cybernetics, IEEE, Hawaii, 2005, 1663–1668.
[21] S. Pan, K. Warwick, M. Gasson, J. Burgess, S. Wang, T. Aziz and J. Stein, *Prediction of Parkinson's Disease Tremor Onset with Artificial Neural Networks*, Proc. of the IASTED Conference BioMed, IASTED, Innsbruck, 2007, 341-345.

[22] H. Sato, Y. Peeri, E. Baghoomian, C.W. Berry and M.M. Maharbiz. *Radio-Controlled Cyborg Beetles: A Radio-Frequency System for Insect Neural Flight Control*, Proc. of 2009. MEMS 2009. IEEE 22nd International Conference on Micro Electro Mechanical Systems, IEEE, Sorrento, 2009, 216-219.
[23] A.M. Abedini and R. Javadpour, *Bionic Hand Enhancement Methods for Precise Motion*, Proc. of 2011 3rd International Conference on Electronics Computer Technology (ICECT), Vol. 1, IEEE, Kanyakumari, 2011, 69-72.
[24] F. Biocca, *The Cyborg's Dilemma: Embodiment in Virtual Environments*, Proc. of Second International Conference on Cognitive Technology. Humanizing the Information Age, IEEE, Aizu-Wakamatsu City, 1997, 12-26.
[25] A.R. Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain*, Putnam, New York, 1994, xvi.
[26] K. Warwick, Ethics Inf. Technol., **12** (2010) 223-234.
[27] S. Rodotà and R. Capurro. *Ethical Aspects of ICT Implants in the Human Body*, no. 20, The European Group on Ethics in Science and New Technologies to the European Commission, Brussels, 2005, 30, online at http://ec.europa.eu/bepa/european-group-ethics/docs/avis20_en.pdf.
[28] K. Barth, *The Doctrine of Creation: Church Dogmatics*, Vol. III, G.W. Bromiley & T.F. Torrance (eds.), T & T Clark, Edinburgh, 1961, 336.
[29] H.W. Wolff, *Anthropology of the Old Testament*, Fortress Press, Philadelphia, 1981, 93.
[30] T.E. Fretheim, *God and World in the Old Testament: A Relational Theology of Creation*, Abingdon Press, Nashville, 2005, 50.
[31] S. Brayford, *Genesis*, Brill, Leiden, 2007, 233.
[32] G. von Rad, *Genesis: A Commentary*, Westminster Press, Philadelphia, 1961, 83.
[33] C. Westermann, *Genesis 1-11: A Commentary*, Augsburg, Minneapolis, 1984, 228.
[34] K. Barth, *Church Dogmatics*, Vol. III, G.W. Bromiley & T.F. Torrance (eds.), T & T Clark, London, 2010, 51, 124-125, 140.
[35] N.L. Herzfeld, *In Our Image: Artificial Intelligence and the Human Spirit*, Fortress Press, Minneapolis, 2002, 82.
[36] T.E. Fretheim, *Creation, Fall, and Flood: Studies in Genesis 1-11*, Augsburg, Minneapolis, 1969, 78.
[37] W. Brueggemann, *Theology of the Old Testament: Testimony, Dispute, Advocacy*, Fortress Press, Minneapolis, 1997, 452.
[38] G. von Rad, *Old Testament Theology*, Vol. 1, Harper, New York, 1962, 146.
[39] T.E. Fretheim, *The Book of Genesis*, in *The New Interpreter's Bible*, Vol. 1, L.E. Keck (ed.), Abingdon Press, Nashville, 1994, 346.
[40] B.C. Birch, W. Brueggemann, T.E. Fretheim and D.L. Petersen, *A Theological Introduction to the Old Testament*, Abingdon Press, Nashville, 1999, 50.
[41] W. Brueggemann, *An Introduction to the Old Testament: The Canon and Christian Imagination*, Westminster John Knox Press, Louisville, 2003, 35.
[42] J. Milgrom, *Leviticus 23-27: A New Translation with Introduction and Commentary*, Doubleday, New York, 2001, 2227.
[43] J. Milgrom, *Leviticus: A Book of Ritual and Ethics*, Fortress Press, Minneapolis, 2004, 311-316.
[44] Congregatio Pro Doctrina Fidei, ASS, **80** (1987) 70-102.