into some of the courses I teach. The authors do a beautiful job of arguing for as much openness and humility in our hermeneutics as in our science, for listening graciously to each other, for a deep understanding of the cultural context of scripture, and for a commitment to resolving apparent conflicts between science and faith. The appeal to seek dialogue and understanding with a commitment to graceful listening is one we certainly need today in science, faith, and beyond.

The book concludes with a call for scientists to bring science into their churches and how doing so can "positively affect the mission and ministry of the church" (p. 120). I found the arguments in this chapter to be the most compelling of the book. I loved the authors' appeal for scientists to step forward to educate their pastors and congregations, to open up and lead conversations about the integration of science and faith, and to serve as a bridge between people of faith who may fear science and those whose worldview puts science in place of God. In a world that seems more divided by the day, this message of education and reconciliation may be the most important of the book.

I enjoyed this book. It is extremely accessible. It would be very useful in first-year college or university courses for science majors, for advanced high school students in Christian schools, in adult discipleship classes in churches, or for individuals. I encourage anyone interested in science and faith to pick it up. It is well worth the short time that it takes to read its few, but valuable, pages.

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TECHNOLOGY

IN OUR OWN IMAGE: Savior or Destroyer? The History and Future of Artificial Intelligence by George Zarkadakis. New York: Pegasus, 2016. xxi + 362 pages, endnotes, index. Hardcover; $27.95. ISBN: 9781605989648.

The origins and possibilities of near-ubiquitous and transformative AI (artificial intelligence) constitute the important subject of this clearly written, often insightful, and provocative work. The book consists of sixteen chapters, framed by an introduction and an epilogue and timeline. This is ambitious popular science writing that weaves together often-contested or speculative ideas and disciplines from history and cognitive archaeology, mathematics, sciences (from quantum theory to psychology), philosophy (expositions here are one of Zarkadakis's strengths), religion (not so much), engineering, and science fiction (he cites many morally serious science fiction stories, novels, and movies). A problem with multidisciplinary attempts, of course, is that one cannot have expertise in everything or be familiar with all the relevant scholarship; the science fiction references, for example, are interesting but far from comprehensive. To his credit, the author, a computer scientist, argues that "essential aspects of being human" remain beyond technological reproduction; our intelligence "cannot be captured in formal rules" and is distinctively *embodied*; and biological consciousness cannot be reduced to computational machines (pp. 278–79). He is doubtful about an imminent, apocalyptic "singularity" of artificial *super*-intelligences.

The book begins with two chapters on deep history. Between 150,000 and 50,000 years ago—before religion or science—language birthed intelligence; we created a symbolic "world of animals and things" endowed with spirit, mind, and meaning. This was "the [cognitive] big bang" that, with naturalistic Paleolithic painting, let us come to terms with inevitable death and ultimately imagine making "robots … as intelligent as ourselves" (pp. 15–16). Zarkadakis zips through millennia of thinking (Aristotle: good; Plato and Descartes: bad), rejecting any hint of nonmaterial life forces or uploadable minds, with helpful discussions of the roles and implications of metaphors, analogies, and narratives in scientific thought about AI. (See chapters three and six on limits to our knowledge.)

Science fiction readers will enjoy the discussion in chapter four, including the old trope of superior robots/androids rising up to exterminate their human creators (see also pp. 270–75). Chapter five, "Prometheus Unbound," further examines fictional anxieties and fears, especially Mary Shelley's incomparable *Frankenstein* (1818); the familiar analysis does not engage the scholarly literature, however. We are becoming cyborgs (chap. six) and could create "digital gods" of "infinite wisdom" but we would lose our humanity in merging with them, Zarkadakis cautions.

Chapter seven discusses questions of mathematics, mind, and more philosophy. Chapter eight argues against mind/body dualism, which contradicts physics and disallows humanlike AI (pp. 118–30). The author criticizes Ray Kurzweil's singularity thesis (after about 2045, AI will be utterly beyond our comprehension) as a "quasi-religious" belief inspired by Teilhard de Chardin's evolutionary theology (as is the cosmic anthropic principle, pp. 126–28). Scientific claims are verifiable or falsifiable; religious ones are neither (p. 130). Chapter nine again contests philosophical dualism; Daniel Dennett's 1991 reductive/

materialist explanation of consciousness is highly regarded (pp. 143–46). Chapter ten unpacks the meanings of "consciousness" following Francis Crick's claim—in his 1994 *Astonishing Hypothesis*, "a book that changed everything"—that it is "entirely due to the behavior of cells … and the atoms … that make them up" (p. 155). Chapter eleven regards cybernetics as omnicompetent, if not omniscient and omnipotent: "ultimately" it could "show us how to govern the evolution of life and the universe," including fully conscious AI (pp. 172–91).

Chapter twelve is a careful discussion of logic from Aristotle, through Boole, Gödel, Turing, and others. Next comes a chapter on the Victorian background to AI, dependent on unnamed historical studies. Chapters fourteen and fifteen move through Colossus and ENIAC to Watson and true machine learning. Zarkadakis suggests that there are reasons to mistrust governments and corporations using AI against citizens, yet AI may turn out to be our savior. Chapter sixteen wonders whether mimicking the structures, connectivity, and feedback loops of human cortical neurons could result in artificial consciousness. Perhaps swarms of self-organizing and reproducing nanorobots could evolve into intelligent organisms. In his Epilogue, Zarkadakis asks if AI will create a utopia. Will we become more human, post-human, more machine-like, or superceded?

Zarkadakis's views of Christianity are often ham-fisted. For example, in Genesis, God creates the first humans, endowing them with free will, resulting in their disobedience. This "stands as a cautionary tale for the … future of Artificial Intelligence. We would not want to repeat the mistake God made with us." As a solution, he references science fiction writer Isaac Asimov who "like a biblical prophet" used his three (hardwired) laws of robotics to restrict the freedom of intelligent robots, preventing them from harming humans (p. 58). Actually, there were four laws, and the most famous three were suggested by Asimov's editor, John W. Campbell. In any event, "we know that the biblical version of humanity's origins is wrong" (p. 217; as if Genesis were a scientific monograph).

According to Zarkadakis, body/mind dualism is the self-contradictory dead end and bane of rational discourse on AI and consciousness: a matter of unverifiable faith, not falsifiable knowledge (e.g., pp. 129–31). Nevertheless, Descartes's separation of the mental and spiritual from the material "liberated" science "from the shackles of the Church." Scientists could now explore what the world was "*really* made of." *Cogito ergo sum* shifted "the debate from 'what is true?' to 'how can we be certain about anything?'" Thus certainty, rooted in biblical revelation, was "shattered beyond repair" (pp. 113–14) and "the scientific method" provided explanations superior to "divine providence" (p. 102). "Most" Christians, says Zarkadakis, believe that at death "the soul goes directly to heaven and that the body perishes forever." And "many scientists with Christian beliefs" still uncritically accept mind/brain, soul/body dualism (p. 126). Scientific explanation is necessarily materialistic, so it is surpassingly strange that "even many practicing scientists" believe in God (p. 134). Lastly, he claims that in order to create AI we "must reject" any version of dualism and "must accept" that "there is no soul"; "there is only matter"; intelligence in any form is "purely material"; and if brains can be conscious, then other material objects can as well (p. 152).

Apart from some typos (e.g., the misspellings of "Planck" on p. 127), there are errors to be noted. Zarkadakis vastly underestimates the number of cells in our body at "several billion" (p. 152). We have far more just in our brains; and if we count the many microbial species we host, the estimated numbers move from hundreds of billions to tens of trillions. William Paley's 1802 work that put forward a watchmaker analogy for design was actually titled *Natural Theology*, and was not the first such argument; and it was not so much negated by Darwin as it was a significant influence on him in the *Origin of Species* (p. 289). Zarkadakis writes that "ten years after [Charles] Babbage's death [in 1871], George Boole demonstrated" the automation of thinking via symbolic logic (p. 229); but by 1881, Boole—whose application of logic to theology is ignored—had been dead for seventeen years.

Zarkadakis often provides helpful social and intellectual context, but his concept of invention does not reflect its complex social nature and contexts. For example, he refers to Bell and the telephone (1876) and Edison and the incandescent light bulb (1879) as simple fact (pp. 230, 319). To be fair, at p. 340, note 14, he refers to historians Robert Friedel and Paul Israel, who identified twenty-two inventors of electric lights before Edison, including Joseph Swan who received a British patent in 1878. (Their study is not identified; see *Edison's Electric Light: Biography of an Invention*, Rutgers University Press, 1986. Even Wikipedia has reliable, up-to-date, nuanced articles on the origins of both the telephone and electric light.) Karel Čapek (not "Capek," p. 319) did not coin the term "robot" in his play *R.U.R.* in 1917; his brother Josef did—and Karel's play appeared in 1921.

A final comment about the book's misleading title, which may be due to the publisher or editor, not the author: *In Our Own Image* alludes to Genesis 1:26, so one might expect a bit more than the book's minimal

biblical/theological content. *Savior or Destroyer?* is a fallacious dichotomy; the two may be mutually exclusive, but together they do not exhaust the possible roles of AI in society. And the book offers *a* history and *a brief possible* future of AI, not *The History and Future* of AI. This is not a definitive history and philosophy of mind, nor of AI science and technology, much less of related science fiction and theology.

Readers interested in a more skeptical treatment of the subject than can be found in Kurzweil's *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (1999); *The Singularity Is Near* (2005); and *How to Create a Mind* (2013) will appreciate Zarkadakis. I would also recommend Noreen Herzfeld's *In Our Image: Artificial Intelligence and the Human Spirit* (2002) and *Technology and Religion* (2009), chap. 3; James Barrat, *Our Final Invention: Artificial Intelligence and the End of the Human Era* (2013); Murray Shanahan, *The Technological Singularity* (2015); Nick Bostrom, *Superintelligence: Paths, Dangers, Strategies* (2016); Yuval Noah Harari, *Homo Deus: A Brief History of Tomorrow* (2016); and Hector J. Levesque, *Common Sense, the Turing Test, and the Quest for Real AI* (2017).

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TECHNOLOGY VS. HUMANITY: The Coming Clash between Man and Machine by Gerd Leonhard. Kent, UK: Fast Future Publishing, 2016. 172 pages, index. Paperback; $15.95. ISBN: 9780993295829.

Technology vs. Humanity is a call to arms against the adversary of *dehumanizing* technology. An influence of tech futurists such as Ray Kurzweil, Alan Turing, Alvin Toeffler, and sci-fi writers such as Ray Bradbury, is evident. Leonhard extrapolates present trends far into the future, but his call to arms is not readily dismissible. If he is correct, we surely must respond. By the time you read this review, it may already be too late, because in Leonhard's view, 2016—the year of the book's publication—is the critical year to take action.

There is a lot to ponder in this book—including but not limited to Leonhard's claim that we reached the pivot point in 2016 (*this* is the very moment when exponential increases are starting to really matter); his ability to envision future technology-generated scenarios and to support them with believable rationales ("What makes us think (these things) won't happen? We simply must consider these unpalatable what-ifs because this is the road we are on—fueled by exponential technologies," p. 83); his account of androrithms (a neologism, or word that Leonhard made up to describe those unique qualities that make us human); his assertion that we will be held responsible for the decisions we make at this very moment (responsible to whom, he doesn't say); and his boldness in attempting to get the conversation started.

Leonhard explains that the pivot point is an inflection point of an exponential curve in many fields of science and technology; now we are moving at "warp speed" toward a blend of hell and heaven that he labels "HellVen." Even if Moore's law eventually ceases to apply as far as microchips are concerned, many fields of technology, from communications to artificial intelligence (AI) and deep learning, are still likely to grow at least exponentially and with combinatorial effects—the changes reinforcing one another. Engineers would call this "positive feedback."

Mathematically speaking, exponential curves do not have an inflection point. Perhaps Leonhard is thinking of the so-called "hockey stick" curve of global temperatures vs. time. Is energy use really rising exponentially? Are food production and consumption, and transportation? Perhaps he is using "exponential" metaphorically, not mathematically. But the concept is central to the argument, so I wish he were more rigorous on this point.

By 2020, Leonhard writes, almost everything will be perceived or defined as a service because everything will be digitized, automated, and "intelligized." This will have huge economic impact as it

> progressively creates abundance in almost every sector of society—first music, movies, and books, followed by transportation, money, and financial services, and eventually, medical treatments, food, and energy. (p. 79)

By 2030

> technology and pharma will have converged almost completely. Mankind's biggest diseases, including cancer, diabetes, heart disease, and AIDS are being tackled by advanced bioengineering. We will very rarely take pills to fight sickness or diseases; instead, we will increasingly use technology and genetic editing to observe, predict, and prevent the onset of diseases. (p. 157)

Leonhard cautions that we should not anthropomorphize our technologies too much or confuse our priorities when it comes to making important societal choices and decisions, and we should not forget our responsibility as we venture out to create technology that may end up surpassing us. Unfortunately, slow but systematic reduction or even discarding of androrithms is already underway. Distinctly human traits include the ability to ask questions, to imagine that something could be different, to be critical, to look at things from different angles, to read between the lines, and to see what may not yet be there. If