While Haight's main purpose for writing this book is admirable, it is doubtful that many outside of academia will take the time and put in the effort that is needed to read it and actually understand it. Christians with more conservative, biblically based faith commitments should probably bypass it altogether, as there is very little, if any, orthodox Christianity that is upheld within its pages.

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TECHNOLOGY

ATOMIC DOCTORS: Conscience and Complicity at the Dawn of the Nuclear Age by James L. Nolan Jr. Cambridge, MA: The Belknap Press of Harvard University Press, 2020. 294 pages, plus index. Hardcover; $29.95. ISBN: 9780674248632.

This book ends with a tragic photograph. The reader will see a young boy carrying a sleeping infant on his back. However, the infant is not asleep but instead is dead as his brother waits his turn to have his brother's body thrown into a giant pyre at Nagasaki in the days following the atomic bomb blast. This picture is symbolic of the tragedy of war and provides a provocative statement regarding the involvement of US physicians in the development of the atomic weapons program toward the end of World War II. The author, James L. Nolan Jr., PhD (Professor of Sociology, Williams College), provides an excellent historical vignette of this period through a written biography of his grandfather, James F. Nolan, MD.

Dr. Nolan, as well as Louis Hempelmann, MD and Stafford Warren, MD, were intricately involved with the Trinity testing in New Mexico as well as with the development of the atomic bomb as part of the Manhattan Project. Dr. Nolan met and collaborated with such famous people associated with the Manhattan Project, including J. Robert Oppenheimer, Edward Teller, and General Leslie Groves. The entire group of physicians oversaw determining radiation risks during atomic bomb development and testing. This placed them in a difficult situation which "linked the arts of healing and war in ways that had little precedent" (p. 166) especially regarding the Hippocratic Oath.[1]

Dr. Nolan was involved with setting up the hospital at Los Alamos as well as providing medical care for the Los Alamos staff and families. However, the job of these clinicians also had other aspects. Radiation exposure to workers was observed and recorded at Los Alamos leading to some of the initial descriptions of radiation poisoning. Additionally, the physicians were involved in determining radiation hazards associated with Los Alamos and in the setting of Trinity with most of their findings either being ignored or hidden from the public, sometimes with the complicity of these individuals. It is fascinating to consider that Dr. Nolan was one of the military personnel chosen to accompany Little Boy (the bomb that exploded over Hiroshima) to the Pacific Front at Tinian Island on the famous and later tragic *USS Indianapolis*. I cannot imagine, in our present time, that a physician would be charged with transporting and reporting the safety of a technologically advanced weapons system.

The book contains many fascinating stories, including how military physicians as well as other personnel were told to assert there was no significant radiation after the bombing in Japan (despite obvious radiation injury being noted in thousands of individuals), how the military allowed reporters at the Trinity test site after the bomb test with no protection except for "protective" booties, how US military physicians were told to not treat Japanese civilians after the bombing in order to circumvent moral responsibility of the bombing (this was ignored), how the inhabitants of the Bikini Atoll and Enewetak Atoll were forced to abandon their ancestral homes so that further atomic bomb testing could occur (with subsequent deleterious effects in their sociologic and health outcomes), and how patients in the United States (many who were already terminally ill) were secretly injected with plutonium to determine the effects of radiation injury.

Besides being a biography and history of a physician and his colleagues, this book also goes in some philosophical directions, including considering what is the goal of technology. Oppenheimer himself stated that "It's amazing … how the technology tools trap one" (p. 33). The "trap" leads to a myriad of issues. Dr. Nolan believed radiation should be considered under the paradigm of an "instrumentalist view of technology" in which new technology could be used for the advancement or decline of our species. In his case, he began experimenting with radiation to treat gynecologic cancer in his patients. The book then explores "technological determinism," both optimistic and pessimistic, which is still an issue permeating our culture today. The author states that humans appear to always choose technologic advances even before fully knowing downstream economic, political, or cultural effects. Such examples cited by the author include the internet, social media, and genetic engineering.

A Christian will find this book unsettling when one considers what one prioritizes in his (her) faith. For example, one of the physicists who worked at Los Alamos was a Quaker. The Trinity test was named after the Christian Trinity (based on a John Donne sonnet). These facts are sobering when the author provides reports of "downwinders" who suffered catastrophic disease after the Trinity test as well as going into detail about the thousands of Japanese who suffered radiation poisoning after the nuclear bombing. In addition, the bombing of Nagasaki was close to the Christian part of the city resulting in the killing of most of the Christians

living there. Indeed, the pursuit of science is a fascinating human endeavor, but the point of science is to objectively determine facts. Science does not necessarily provide subjectivity by itself which allows it to be influenced by meaning, moral values, and responsibility.[2] In the moral arena, people with religious beliefs, including Christians, are required to influence the idea of technologic determinism in a positive direction. I highly recommend this book not only to learn about an interesting part of world history but also to appreciate the tragedy of the human condition in the setting of war.

Notes

[1]Michael North, translator, "Greek Medicine," History of Medicine Division, National Library of Medicine, National Institutes of Health, last updated February 7, 2012, https://www.nlm.nih.gov/hmd/greek/greek_oath.html.

[2]Mehdi Golshani, "Science Needs a Comprehensive Worldview," *Theology and Science* 18, no. 3 (2020): 438–47.

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THE ETHICAL ALGORITHM: The Science of Socially Aware Algorithm Design by Michael Kearns and Aaron Roth. New York: Oxford University Press, 2019. 232 pages. Hardcover; $24.95. ISBN: 9780190948207.

Can an algorithm be ethical? That question appears to be similar to asking if a hammer can be ethical. Isn't the ethics solely related to how the hammer is used? Using it to build a house seems ethical; using it to harm another person would be immoral.

That line of thinking would be appropriate if the algorithm were something as simple as a sorting routine. If we sort the list of names in a wedding guest book so that the thank-you cards can be sent more systematically, its use would be acceptable; sorting a list of email addresses by education level in order to target people with a scam would be immoral.

The algorithms under consideration in *The Ethical Algorithm* are of a different nature, and the ethical issues are more complex. These algorithms are of fairly recent origin. They arise as we try to make use of vast collections of data to make more-accurate decisions: for example, using income, credit history, current debt level, and education level to approve or disapprove a loan application. A second example would be the use of high school GPA, ACT or SAT scores, and extra-curricular activities to determine college admissions.

The algorithms under consideration use machine-learning techniques (a branch of artificial intelligence) to look at the success rates of past student admissions and instruct the machine-learning algorithm to determine a set of criteria that successfully distinguish (with minimal errors) between those past students who graduated and those who didn't. That set of criteria (called a "model") can then be used to predict the success of future applicants.

The ethical component is important because such machine-learning algorithms optimize with particular goals as targets. And there tend to be unintended consequences—such as higher rates of rejection of applicants of color who would actually have succeeded. The solution to this problem requires more than just adding social equity goals as part of what is to be optimized—although that is an important step.

The authors advocate the development of precise definitions of the social goals we seek, and then the development of algorithmic techniques that help produce those goals. One important example is the social goal of privacy. What follows leaves out many important ideas found in the book, but illustrates the key points. Kearns and Roth cite the release in the mid-1990s of a dataset containing medical records for all state employees of Massachusetts. The dataset was intended for the use of medical researchers. The governor assured the employees that identifying information had been removed—names, social security numbers, and addresses. Two weeks later, Latanya Sweeney, a PhD student at MIT, sent the governor his medical records from that dataset. It cost her $20 to legally purchase the voter rolls for the city of Cambridge, MA. She then correlated that with other publicly available information to eliminate every other person from the medical dataset other than the governor himself.

Achieving data privacy is not as simple as was originally thought. To make progress, a good definition of privacy is needed. One useful definition is the notion of *differential privacy*: "nothing about an individual should be learnable from a dataset that cannot be learned from the same dataset but with the individual's data removed" (p. 36). This needs to also prevent identification by merging multiple datasets (for example, the medical records from several hospitals from which we might be able to identify an individual by looking for intersections on a few key attributes such as age, gender, and illness). One way to achieve this goal is to add randomness to the data. This can be done in a manner in which the probability of determining an individual changes very little by adding or removing that person's data to/from the dataset.

A very clever technique for adding this random noise can be found in a *randomized response*, an idea introduced in the 1960s to get accurate information in polls about sensitive topics (such as, "have you cheated on your taxes?"). The respondent is told to flip a coin. If it is a head, answer truthfully. If it is a tail, flip a second time and answer "yes" if it is a head and "no" if it is a tail. Suppose the true proportion of people who cheat on their taxes is p. Some pretty simple math shows that with a sufficiently large sample size (larger than needed for surveys that are less sensitive), the measured proportion, m, of "yes" responses will be close to $m = \frac{1}{4} + \frac{1}{2}p$. We can then approximate p as $2m - \frac{1}{2}$, and still give individuals reasonable deniability. If I answer "yes"