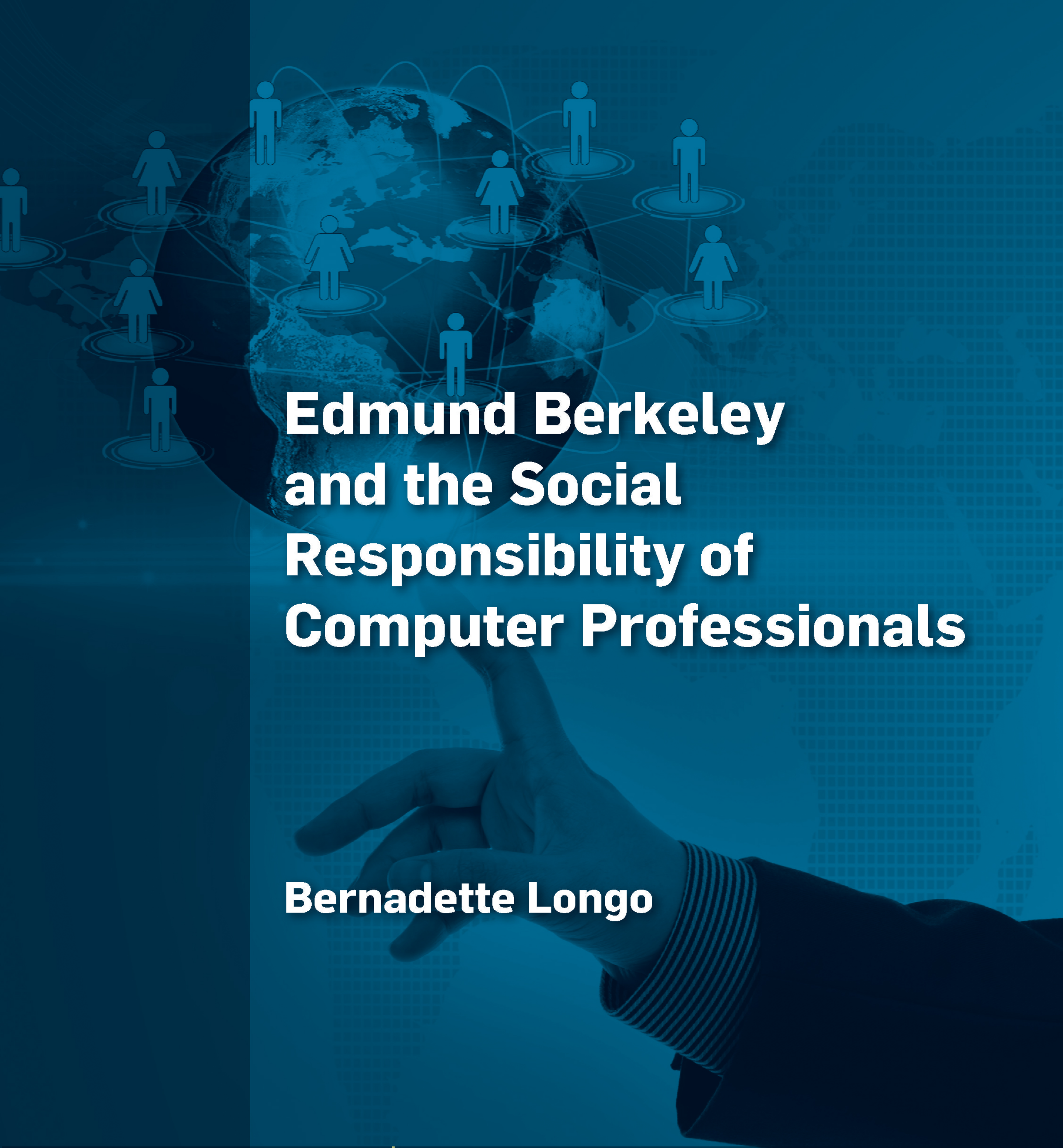

Edmund Berkeley and the Social Responsibility of Computer Professionals

Bernadette Longo

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Preface

The idea for this book began fifteen years ago with a question: How has the language we use to describe computers influenced what we believe are (im)possible relationships between humans and these machines? As I considered this question further, I focused on metaphors that people used to describe computers as this technology moved from military to civilian applications in the United States after World War II. At this initial stage of the project, Peggy Kidwell[1] was instrumental in suggesting relevant materials at the National Museum of American History Archive Center, as well as in the Smithsonian Institution archives. With her help, I received Smithsonian Institution travel funding and a Lemelson Center Fellowship to support this project as it took shape around the metaphors of "robot" and "brain." Peggy's intellectual generosity and support at this early stage of the project gave me confidence that my research question and direction were important enough to seriously pursue.

Once it became clear that the metaphors of "mechanical brain" and "robot brain" had been instrumental in shaping our understanding of human-computer relations, it was not long before Steve Lubar[2] suggested that I look into the work of Edmund Callis Berkeley, who had published the book *Giant Brains or Machines That Think.* He suggested that perhaps it was time for someone to write a biography of Edmund Berkeley; I considered it. I heard that Paul Ceruzzi[3] had met Berkeley and had seen Squee the robot squirrel in person. So I asked Paul if we could talk about this idea of a Berkeley biography. Paul was also encouraging; I decided to take on the challenge of writing this book.

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1. Peggy Kidwell is a Curator in the Division of Medicine and Science, The National Museum of American History at the Smithsonian Institution.

2. From 1984–2005, Steve Lubar was a Curator at The National Museum of American History at the Smithsonian Institution. He is currently a Professor at Brown University.

3. Paul Ceruzzi is a Curator with the National Air and Space Museum at the Smithsonian Institution.

As I wrestled with the decision to write this book, I also talked with David Alan Grier[4] about the idea. He was generous with his support and knowledge about Berkeley, the insurance industry, and the cultural context surrounding computer development after World War II. In the many years between my decision to write a biography and the completion of this book, I am sure that Peggy, Paul, Steve, and David had given up hope that I would ever finish it. I dedicate this completed book to them and thank them for their early support that convinced me of this project's importance.

After deciding to write this biography, the next step was to contact the Charles Babbage Institute (CBI) at the University of Minnesota where Berkeley's papers are archived. My initial CBI contact was Elisabeth Kaplan,[5] whose enthusiasm for this project was combined with her knowledge of the archive's extensive materials for research. Beth explained the provenance of the Berkeley materials, which gave me an initial sense of my subject's character and opened the door to many, many hours of time travel through Berkeley's life.

In my pursuit of information about Edmund Berkeley, I visited schools where he was a student and met some extraordinarily helpful people along the way. Berkeley's early schooling took place at St. Bernard's School at 111 East 60th Street in New York City. Virginia Tracy[6] and other staff members there showed me archival documents so I could get an understanding of the breadth of humanistic, scientific, and artistic studies that Berkeley experienced as a child. From St. Bernard's, Berkeley continued his education at Phillips Exeter Academy in New Hampshire, where I was welcomed by Academy Archivist Edouard Desrochers[7] who generously provided materials from Berkeley's years there (1923–1925). Not only did Mr. Desrochers find copies of the Academy's monthly newsletter to help me understand the context of Berkeley's studies, he also found a diary Berkeley kept while at school. Although material from the diary does not appear directly in this biography, the depth of understanding that I gained from Berkeley's teenaged thoughts certainly informed my portrayal of his character.

4. David Alan Grier is an Associate Professor of International Science and Technology Policy and International Affairs at the Elliott School of International Affairs, The George Washington University. He was the 2013 President of the Computer Society of the Institute for Electrical and Electronic Engineers (IEEE).

5. From 1999 through 2005, Elisabeth Kaplan was an Archivist at the Charles Babbage Institute, University of Minnesota. She is currently the Associate University Librarian for Special Collections, Archives, and Global Resources at The George Washington University.

6. When I visited St. Bernard's School in 2002, Virginia Tracy was the Director of Alumni. She is currently the Director of Annual Giving.

7. Edouard L. Desrochers is the Assistant Librarian and Academy Archivist at Phillips Exeter Academy, where I visited in 2003.

In the fall of 1926, Berkeley entered Harvard University as a mathematics major. In the fall of 2003, I visited the Harvard University Archives to look into materials relating to mathematics instruction during Berkeley's years there. The Harvard University archivists not only provided the materials I thought I wanted to see, they also found alumni documents containing periodic reports written by Berkeley himself. My time at the Harvard University Archive proved to be extremely fruitful because of the interest and initiative of the staff there.

Throughout the fifteen years I worked on this biography, I have benefited greatly from my collaborations and discussions with talented librarians, archivists, and fellow researchers. It was during one of those discussions at the Archive Center at the National Museum of American History when Archivist Alison Oswald[8] and her colleagues suggested that I request Edmund Berkeley's FBI file under the Freedom of Information Act. Although it took some time to receive this file, the material contained in it gave me an appreciation for the importance of the political context relating to Berkeley's work. The suggestion to request Berkeley's FBI file turned out to be a pivotal decision for the story about his life that's told here.

This story about Berkeley has also been built on research that resulted in five published articles in the *IEEE Annals on the History of Computing, Communications of the ACM, Comparative Technology Transfer and Society,* and the *Journal of Technical Writing and Communication*. I have also given presentations on this project to groups from Aarhus University in Denmark, the Charles Babbage Institute at the University of Minnesota, and the Lemelson Center in Washington, D.C. At each of these intermediate steps, I appreciated the comments, questions, and suggestions I received from readers and audience members. It was through one of these exchanges that I came in contact with Eric A. Weiss,[9] who knew Berkeley personally and was willing to share his first-hand knowledge with me during a telephone conversation. I hope this biography does justice to Eric's memories of Berkeley.

Acknowledgments

In addition to the individuals and organizations already mentioned, my research for this biography has been generously supported by the Association for Computing Machinery, which awarded me a History Committee Fellowship in 2012 to complete

8. Alison L. Oswald is an Archivist for the Lemelson Center and Archives Center for the National Museum of American History at the Smithsonian Institution.

9. Eric A. Weiss served as the Editor of the Biography Department for the *IEEE Annals of the History of Computing* from 1988 through 1992. He is the author of a number of biographies of computer pioneers, as well as histories of computer development.

the project. While I was on the faculty at the University of Minnesota, I also received two grants to underwrite travel to archives.

In these final stages of the project, I want to express my gratitude to M. Tamer Özsu[10] for his support of this biography about one of the more controversial of ACM's founders. Working with Diane Cerra[11] and Paul Anagnostopoulos[12] in the final editing process and production has brought this project to a speedy and painless conclusion. I especially thank the reviewers for their helpful comments, as well as Diane and Paul for their dauntless good cheer.

Most importantly, I want to thank the staff at the Charles Babbage Institute for their abiding support for this project over the seemingly impossible length of time it took to come to completion. Over the years, Jeff Yost[13] lent his quiet support to this project, which gave it the exposure I needed to remain confident in the importance of this story. R. Arvid Nelson[14] and Katie Charlet[15] helped me find materials and resources during intense research visits that finally all came together in a coherent narrative. Tom Misa[16] never wavered in his enthusiasm for telling Berkeley's story, even when my enthusiasm was at its lowest points. Tom's attitude helped me to bridge gaps that might otherwise have been too deep for me to cross alone on the journey to completion. Thank you, Tom.

Finally, I want to thank Edmund C. Berkeley for living a principled life, for writing so much, and for saving his work.

10. M. Tamer Özsu is Editor in Chief at ACM Books.

11. Diane Cerra is Executive Editor at Morgan & Claypool Publishers.

12. Paul Anagnostopoulos is the owner of Windfall Software, producing technical books in TEX using ZzTEX and LaTEX.

13. Jeff Yost is the Associate Director of the Charles Babbage Institute at the University of Minnesota. He was the Editor-in-Chief of the *IEEE Annals of the History of Computing* from 2008 through 2011.

14. R. Arvid Nelson is an Archivist in the Charles Babbage Institute at the University of Minnesota.

15. Katie Charlet is the Administrator of the Charles Babbage Institute at the University of Minnesota.

16. Tom Misa is the Director of the Charles Babbage Institute and a Professor in the Department of Electrical and Computer Engineering at the University of Minnesota.

Introduction: A Struggle of Ideas

Edmund Callis Berkeley was born on March 20, 1909 in New York City. From 1918–1923, he attended St. Bernard's School for Boys at 111 East 60th Street, where he learned about the sciences, the arts, creativity, and character. During that time, Berkeley recalled, "The first ambition I ever had was to paint black fences orange. In New York in the East Sixties when I was a child being taken to the park, I used to see every now and then men in white suits transforming dirty iron fences into radiant red-orange glory."[1] Berkeley never lost this ambition to transform "what is" into "what could be."

Berkeley continued his education from 1923–1925 at Phillips Exeter Academy, where he was the youngest student, yet graduated first in his class. At this time in his life, Berkeley wanted to be "a mining engineer, so as to find mineral specimens in exotic places."[2] His teachers at Phillips Exeter, however, recognized Berkeley's exceptional mathematical talents and singled him out for individual tutoring. He received support for his studies from the Phillips faculty, but did not fit in well with the sons of the elite families who made up the majority of students at this distinguished prep school. Most of the Exonians lived in dormitories on campus; Berkeley lived at a boarding house in town. He was overly intelligent, socially awkward, and not well accepted by his fellow students, some of whom were ten years older than this sixteen-year-old brainiac.

Feeling he was too young for college when he graduated from Phillips at 16, Berkeley's parents kept him out of school for a year. He worked as an instructor at his alma mater, St. Bernard's School, and lived in his family home on the Upper West Side near Columbia University. In 1926, he entered Harvard College, where he majored in mathematics and graduated summa cum laude four years later. After his first year

1. Berkeley, 1955.

2. Ibid.

at Harvard, Berkeley changed his mind about becoming a mining engineer. He realized "how much hard work was the lot of your mining engineer, the disadvantages of your distance from civilization, and how distressingly inaccurate your data and your conclusions had to be."[3] Berkeley decided on a career as a creative mathematician.

In a commencement address he delivered at Harvard on June 19, 1930, Berkeley highlighted the most lasting lesson gained from his college years: "But what most distinguishes us today as seniors from the freshmen we were four years ago is that we have gained methods of thinking, a set of tools for finding out facts, and these methods will remain because they have become subconscious in our habits."[4] This concern with "Modern Methods of Thinking" would become the focus of Berkeley's work for the rest of his life.

When Berkeley graduated from Harvard in June 1930, the Great Depression was deepening. Unemployment had risen to over 4 million, from 429,000 before the stock market crashed in October 1929. By 1930, the Metropolitan Life Insurance Company reported that 24% of its policy holders in 46 larger U.S. cities were jobless.[5] In New York City, homeless people built a shantytown called "Hoover Valley"[6] in an abandoned reservoir north of Belvedere Castle in Central Park, where they lived just under the windows of tony Fifth Avenue and Central Park West apartments. By the end of 1930, nearly 6,000 people could be found selling apples for five cents apiece, eking out a living on New York City street corners.[7] In the midst of unemployment and economic uncertainty, Berkeley's parents pressured him to be practical and reconsider his career as a creative mathematician: "[T]his was sublimated, by repeated parental urging, into the applications of mathematics in business: actuarial work in the life insurance business. . . . 'Go to work in a big business where you can be secure and your income will rise year after year to a good figure; never mind what you really want to do,' said the Circe of being practical." [8] In 1930, Berkeley went to work as a clerk in the actuarial department of Mutual Life Insurance Company, where he worked for four years.

In 1934, Berkeley "broke out of this cocoon" after inheriting a little over $8,000 from his aunt. He used the money to travel for three and a half months, visiting ten countries including Norway, the Soviet Union, Greece, and Italy. In the autumn of that

3. Ibid.

4. Berkeley, 1930.

5. Piven & Cloward, 2009.

6. Gray, 1993.

7. Anonymous, 2003.

8. Berkeley, *1955*.

year, Berkeley returned from his travels and took a job in the actuarial department at Prudential Insurance in Newark, New Jersey.

Once the United States entered World War II, Berkeley joined the many Prudential employees who were given leave for active military duty. In 1942 he enlisted in the Navy and served as a Naval Reserve officer for three and a half years. His first assignment was with the Office of the Inspector in Newark, where he supervised supply distribution. He was later reassigned to a post that better utilized his skills, under Howard Aiken at the Harvard Computation Laboratory. Berkeley described this assignment as “a really stimulating experience.”[9]

The Harvard Lab had been established in the summer of 1944 when IBM installed the Mark I relay computer there. This machine was designed by Harvard physicist and Navy Commander Howard Aiken, and built in collaboration with IBM engineers. The Mark I, one of the first automatic digital calculating machines, was a general purpose machine built from 765,000 components: switches, relays, rotating shafts, and clutches. At 51 feet long, two feet wide, and eight feet high, it filled its Cruft Hall room and required nearly constant attention from a number of highly trained people. The Mark I relied on external programming fed into it via long rolls of punched paper tape and data loaded via punched cards. Results were printed directly from the machine via automatic typewriters in a format that the people running the machine could understand. Mark I often ran around the clock to produce mathematical tables that were camera-ready for distribution as they came from the machine’s typewriters.[10] Berkeley was assigned to help run this automatic calculator and to design the next generation of relay computer—the Mark II.

After the war, Berkeley returned to work at Prudential Insurance where he “began to work on some of the most interesting assignments I had ever had. . . . About two-thirds of the time was spent in determining how the company could make use of new automatic electronic equipment for handling information. This was the most satisfying combination of work and pleasure that I had yet put together. But a change of vice-presidents resulted in extensive curtailment of this assignment.”[11] In 1948, Berkeley resigned from Prudential to go into business for himself as a consulting actuary, writer, publisher, teacher, and developer of small computers and robots. The topics his company, Berkeley Enterprises, was particularly interested in included “symbolic logic, computers, robots, mathematics, operations research, language,

9. Ibid.

10. Wilkes, M.V., 1985, 124. See also Cohen, I. B., 2000b, Chapter 19.

11. Berkeley, *1955*.

[and] explanation." He later recalled, "I threw caution to the birds at last, but for the first time I was able to call my soul my own."[12]

Berkeley's soul was his own, but he learned to be careful about how he shared it with the world. In his 1955 biographical entry in the *Harvard Class of 1930 25th Anniversary Report*, he described his views on controversial subjects in terms that he hoped would not arouse suspicions about his loyalty: "As to social, political, and/or religious views, I have some strong convictions. But as a result of Mr. Joe McCarthy and some other people who promote 'guilt by association,' I don't speak out as freely as I used to." He was concerned that the average person's voice was heard: "Socially, I am in favor of the underdog, and the common man; and I am opposed to people who push them around." At the same time, he was troubled with Cold War politics and the direction that American culture was taking: "Politically, I am convinced that the Russians will never start a shooting war with the United States. The basic reason is that the Russians believe they have some world-beating ideas, and the Americans are generally too busy with the American physical world to pay much attention to the mental world of other countries. So I think that peace is going to break out. . . . I believe that all the Russians have to do to be victorious over the Americans in the next hundred years is to allow the Americans to continue to watch television." Ultimately, Berkeley believed that a well-educated, well-informed populace was the best defense for American values: "[T]he struggle of this century, it seems to me, is a struggle of ideas. It looks as if no war can be won any more with guns or bombs or any hardware, but only with ideas . . . . Further, before Americans can make rational judgments about the rest of the world . . . they have to study more perceptively and blow their mouth off less." Berkeley saw his role as that of an opinion leader and social activist, and he was willing to do his homework to arrive at constructive advice: "It seems to me that the objective, comparative study of people, cultures, and social behavior—I suppose you would call it social anthropology—is the *sine qua non* of our times."[13] Berkeley was a student of human nature, as well as machine intelligence.

Berkeley saw the 20th century as an era in which ideas were stronger than nuclear bombs and guided missiles. Once they could destroy the world many times over, these weapons had outgrown their usefulness. After people developed weapons that allowed one country to annihilate the world, national leaders had to choose alternative strategies to total war. The era of World Wars had ended. In the future, wars of ideas would be contained and psychological. They would be waged by implied threat,

12. Ibid.

13. Ibid.

economic strategies, and propaganda, like the Cold War between the United States and the Soviet Union. These wars of ideas could occasionally turn into localized battles with physical weapons. But whether the fighting was hot or cold, computers and the people who develop them would be implicated in these battles.

Berkeley was not alone in his belief that computer professionals were necessarily implicated in social questions, especially those concerning the ethics of weapon development. In a widely publicized statement in the December 1946 *Atlantic Monthly*, MIT professor Norbert Wiener declared his opposition to using his mathematical knowledge "for war purposes." Wiener, respected as one of the world's leading mathematicians, replied to a colleague who asked for help in developing a missile guidance system, "The policy of the government itself during and after the war, say in the bombing of Hiroshima and Nagasaki, has made it clear that to provide scientific information is not a necessarily innocent act, and may entail the gravest consequences. . . . The interchange of ideas, one of the great traditions of science, must of course receive certain limitations when the scientist becomes an arbiter of life and death." Wiener considered the question of how other people applied his mathematical knowledge to be a "serious moral issue."[14] In January 1947, Wiener had his name removed from the list of speakers at the Navy-sponsored Symposium on Large-Scale Digital Calculating Machinery held at Harvard University—a conference that Berkeley attended. Wiener "refused to appear because of his stand on use of scientific advancements for war purposes."[15]

Wiener continued to investigate the future of automated weapons, although he refused to lend his abilities to their development. In 1959, for example, he presented a paper entitled "On the Technical Development of Automatization and Some of its Moral Consequences" at the Symposium on Science and our Future sponsored by the American Association for the Advancement of Science. The thesis of Wiener's paper was that "machines can and do transcend some of the limitations of their designers, and that in doing so they may be both effective and dangerous. It may well be that in principle we cannot make any machine, the elements of whose behavior we cannot comprehend sooner or later." For Wiener, the danger of these learning machines that would inevitable become unknowable—even by their human developers—was that the machines "will be used to program the pushing of the button in a new push-button war."[16] Berkeley studied Wiener's paper and shared his concern for the prospects of future warfare automated by learning machines that were both intelligent and lethal.

14. Wiener, N., 1946.

15. Anonymous, "Wiener Denounces Devices 'For War,'" January 8, 1947.

16. Wiener, N. December 27, 1959.

In the 1960s, Berkeley also corresponded with Joseph Weizenbaum, a computer science professor at MIT and developer of the natural language processing program ELIZA. Weizenbaum shared a concern with the ethical aspects of applications of intelligent machines with Wiener and Berkeley, arguing that it "could be both dangerous and immoral to assume computers could eventually take over any human role." He wrote, "No other organism, and certainly no computer, can be made to confront genuine human problems in human terms."[17] Berkeley, too, recognized the dangers of autonomous intelligent machines, as well as their potential benefits for improving people's lives. The tension between benefit and threat that characterized this human-machine relationship meant that the people who developed intelligent machines were necessarily involved in questions of ethics and social responsibility.

With the Perspective of Time

What would Edmund Berkeley have to say about the relationships we have with our intelligent machines at the beginning of the 21st century? He worked with computers at a time when people made intelligent machines on their kitchen tables. Berkeley built small robots and sold them through the mail, but he worried that in the future people could use these machines as superhuman soldiers. What would he say today about the ethics of using lethal autonomous weapons systems to replace humans on the battlefield? Currently, more than "50 nations have or are developing military robots like we have [in the U.S.], including China, Iran, Libyan rebels and others."[18] Are lethal autonomous weapons systems subject to the same international humanitarian laws that apply to human beings? This is a question that was recently discussed for five days in April 2015 at the United Nations Office at Geneva.[19] Representatives from more than 30 countries and a dozen additional organizations interrogated the challenges and issues of using self-directed robot warrior systems. This is not a question of physical or mathematical laws, which are trivial to calculate compared to the social questions we face. It is a question of laws, politics or technology—our social behavior. Or as Edmund Berkeley posed the question, what social responsibility do technology developers have to the rest of us?

In the 1950s, Berkeley developed robots and made them readily available to anyone who could pay $20 for the mail-order kit. He believed that the people who built these

17. Rising, D. and Pratt, N., March 13, 2008.

18. See Lin, P., 2011.

19. See UN 2015 Meeting of Experts on LAWS.

kits would learn about computers, logic, and sound reasoning. They would learn modern methods of scientific thinking. Berkeley believed that people would apply the logical habits they learned from these robot kits to social questions, and they would choose to apply their knowledge for the benefit of humanity. But during the Cold War decades he was faced with evidence to the contrary as he watched computer scientists increasingly work on weapons to wage war rather than applying their expertise to wage peace.

For Berkeley, the important question about computers and robots was "How shall they be used?" Today, Berkeley's question is still relevant. We currently ask this question about "big data," for example, especially when people's civil rights are threatened by these "intelligence gathering" operations. Chris Soghoian from the American Civil Liberties Union doubts whether we can control the intelligent systems we have developed to collect data on ourselves: "The availability of the data leads to more tools to analyze it, and the availability of the tools leads to more collection of data. It's an unpleasant circle."[20] In *Time Magazine*, Bryan Walsh poses the most important "big-data challenge, one that can't be answered with algorithms: how it should be used."[21] We might be on the verge of developing fully autonomous and adaptive machines using robotics based on biological evolution.[22] Who will control these intelligent machines once they have "learned" their own metaheuristic, evolutionary algorithms? In a *Smithsonian Magazine* article on identity theft, Joseph Stromberg voices a common plea: "We create these machines. The least they could do is recognize us."[23]

In a *Forbes* article, Milo Jones and Philippe Silberzahn suggest that our reliance on big data "is a legacy of 1950s positivism, the naïve belief that human systems are amenable to Newtonian solutions, and that complex geopolitical situations and social movements can be understood by counting physical devices or parsing Internet log files. They can't."[24] These authors argued, "Far from enabling counter terrorist strategy, such technical programs erode civil liberties and cloud the minds of counter-terror strategists. . . . No volume of data will generate of the right questions or the right analytical focus, so no amount of data will keep America safe, either physically or economically. In fact, the opposite is true."[25]

20. Walsh, B., 2013.

21. Ibid.

22. See Bongard, J. C., 2013.

23. Stromberg, J., 2013.

24. Jones, M. & Silberzahn, P., 2013.

25. Ibid.

To create a safer world, Berkeley advised us that the "best kind of help the common man could have . . . is a return in conversation (and in all mediums of communication) to free, honorable, and friendly discussion, where each person is free to say what he thinks without punishment, and everyone concerned investigates, the more scientifically the better."[26] Berkeley's conversations place human beings at the center of the debate about the social impacts of computer applications. Perhaps we are reaching the time when we will need to include our intelligent machines in such conversations, too. This is a question Berkeley would surely have enjoyed discussing. His focus was on the future.[27]

The Myth of Autonomy

Berkeley counted himself among the scientists and technology developers after World War II who believed that the best way to ensure international cooperation in the political sphere was to openly share information in the scientific sphere. Advocacy of an open exchange of scientific information was very much in an internationalist scientific tradition, through which scientists from different parts of the world could collaborate and share information. It was this model of open information sharing that ensured the most efficient and productive scientific and technological developments. Sociologist Edward Shils argued that in a social sense, this model represented "an inner affinity between science and the pluralistic society. The conduct of scientific research

26. Berkeley, E., 1955.

27. In the course of writing this book, I wondered whether Berkeley had an influence on the people who established Computer Professionals for Social Responsibility in 1982. According to their website, this group was "dedicated to raising the awareness of the profession and the public with regard to the dangers inherent in the use of computers in critical systems," the same concerns Berkeley raised 30 years earlier. I contacted Doug Schuler to ask if he or others in CPSR had heard of Edmund Berkeley. Mr. Schuler forwarded my question to others in the group, and to Severo Ornstein in particular. Mr. Ornstein replied that he had asked others in the group and their response was that Berkeley's effect on them was at best indirect through his formation of the Association for Computing Machinery. Mr. Schuler said that he had not met Berkeley, but had "a copy of two of his newsletters." However, Berkeley had an influence on Mr. Schuler through the parable of "The Three Bricklayers" that Berkeley included in his book *Ride the East Wind* (1973). In Berkeley's parable, the author asked three bricklayers what they were doing. The first answered, "I am laying bricks." The second answered, "I am building a straight wall." The third answered, "I am building a cathedral." Mr. Schuler said, "I KNOW [Berkeley] made an impact on me—but through his fables and parables book! In some of my presentations at conferences . . . I used first his 'three bricklayers' parable and then my analogous 'three community networkers."' Here is Mr. Schuler's parable: The first community networker answered, "I'm setting up a mail distribution list and some web pages." The second answered, "I'm working with a social service agency to develop community projects." The third

requires a pattern of relationships among scientists which is the prototype of the free society. In microcosm, the scientific community mirrors the larger free society."[28] But what happens when the open sharing of scientific information is curtailed to protect national security? What happens when politics reins in autonomous science?

In general terms, Thomas Kuhn argued that rather than being autonomous, science is always constrained by expectations and values held by a dominant group of "insiders." For Kuhn, scientific "paradigms," or models of accepted knowledge, "gain their status because they are more successful than their competitors in solving a few problems that the group of practitioners has come to recognize as acute. To be more successful is not, however, to be either completely successful with a single problem or notably successful with any large number."[29] In arguing that practitioners use paradigmatic understandings to determine acceptable and unacceptable "scientific knowledge," Kuhn argued that science is inherently practiced within political contexts. In other words, scientists do not operate in free and open societies; they necessarily operate within community constraints. It is within this tension between scientific, physical truths and political, social values that Berkeley's story resides.

In his 1956 sociological exploration of the tension between science and secrecy, Edward Shils articulated the altruistic hope of logical positivism:

> The standard of truth in science has nothing to do with the criteria of political success or of political loyalty. . . . Whether a scientific proposition is true or false depends not at all on whether the person who asserts it is a loyal American, a loyal Russian, a disloyal American, or a politically indifferent Frenchman or Pole. A member of the Communist Party might be a poor scientist, but the determination as to whether he is a poor scientist can be made only by qualified scientists who would not consider his Communist affiliation in arriving at their judgment.[30]

In practice, this idea that scientific autonomy operates outside politics is an unattainable ideal. The case of Robert Oppenheimer's 1954 security hearings, for example, showed the inextricable links between science and politics. Sociologist Charles Thorpe argued that "the incorporation of science into the administrative apparatus of government has involved disciplining scientific experts and fashioning scientific

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answered, "I'm helping to build a new society." Mr. Schuler stated, "I think it's a powerful frame and it came right from his book—but not specifically on either computers or social change."

28. Shils, E. A., 1956/1996, 176.

29. Kuhn, T., 1970, 23.

30. Shils, E. A., 1956/1996, 178.

authority after the bureaucratic model of the state."[31] Considering this hearing within a tension of scientific autonomy and national security, Thorpe found that it was "a contest for legitimacy and for the right to define the cultural and political role of science. It was an event which crystallized tensions between competing understandings of the legitimate place of scientists and scientific expertise in the operations of the state and in civil society. Questions of Oppenheimer's character, associations, and loyalties, and arguments about the propriety of his opposition to the H-bomb, were also arguments about the legitimate characteristics, scope, and political role of scientific authority."[32]

Before this security hearing, Oppenheimer was "America's foremost scientific advisor to government."[33] After the hearing, his character was disgraced, he was stripped of all security clearances, and he "emerged from the trial broken, humiliated, and visibly aged."[34] Oppenheimer's was a highly visible case of politics disciplining scientific knowledge. His hearing took place under the glare of publicity and his downfall was equally public. But many more people's lives were affected by hearings that took place in secured rooms away from the public eye, as the case of Edmund Berkeley illustrates.

Ultimately, Berkeley's story is one of electronic computer development and politics. Ever the inventor, Berkeley transformed his visions of the future into intelligent machines to help people make good decisions. Ever the teacher, Berkeley transformed his trials into parables to help people tell truth from falsehood. With the perspective of time, we can follow his story somewhere in the grey areas between true and false.

31. Thorpe, C., 2002.

32. Ibid. 528.

33. Ibid., 525.

34. Ibid., 528.

1 Modern Methods of Thinking, 1927–1941

I claim, for Symbolic Logic, a very high place among recreations that have the nature of games or puzzles; and I believe that any one, who will really try to understand it, will find it more interesting and more absorbing than most of the games and puzzles yet invented.

—Lewis Carroll[1]

Edmund Berkeley was captivated by the Complex Number Calculator at Bell Laboratories in New York City. It was the late fall of 1939 and mathematician George Stibitz was completing the device with Samuel Williams, a switching engineer at Bell. Stibitz first assembled the Complex Number Calculator on his kitchen table, using relay switches he brought home from Bell Telephone Laboratories. "He fastened two relays . . . to a piece of plywood, cut strips from a tobacco can, bought two dry cell batteries and some flashlight bulbs, and with some electrical work constructed a one-digit binary adder."[2] When a tin strip from the tobacco can was pressed down, its corresponding bulb lit to indicate the digit 1; an unlit bulb indicated the digit 0. "Simple or not . . . it worked: press both strips down for 1+1, say, and the light bulbs would flash 1 and 0, the binary equivalent of 2."[3] When Stibitz showed this binary calculator to his Bell Labs colleagues, they found it amusing. But he was not discouraged from continuing to work on this binary calculating device, which he developed into a more sophisticated relay-based computer that was operational in 1940.

The Complex Number Calculator was about three months away from going into service at Bell Labs, but Berkeley already realized that this mechanical device could help

1. Carroll, L. (1896/1977), 45.

2. Tropp, H. S., 1995.

3. Waldrop, M.M., (2001), 35.

people think. If people could work with digital computers like the Complex Number Calculator to apply symbolic logic to complex, ill-defined social problems, then there was a possibility that people could make better decisions about war and finances and other things that affected society at large. This rudimentary computer started Berkeley thinking about automating modern methods of thinking that could help people avoid large-scale social problems. He believed that people working with mechanical brains could make decisions based on rational science vs. human emotion. He saw that this modern, scientific approach to social decision-making could help people avoid social disasters like the crash of the stock market in 1929 that sunk nations into the Great Depression that still gripped the country a decade later.

Berkeley immediately understood how this rudimentary relay computer could automate the actuarial calculations that he routinely performed in his job with Prudential Insurance. In a memo to his supervisors, Berkeley pointed out the similarities between the operations that he saw at the Bell Labs demonstration and the operations performed at Prudential. He described this relay system for handling large volumes of pattern arithmetic as "remembering and calculating numbers."[4] Because the processes of multiplying and dividing took so many more steps than adding and subtracting, Berkeley noted that the "girl computers" at Bell Labs used the Complex Number Calculator for these more complex calculations during the 1939 demonstration:

> Six or eight panels of relays and wires were in one room. Two floors away, some of the girl computers sat in another room, where one of the teletypewriters of the machine was located. When they wished, they could type into the machine's teletypewriter the numbers to be multiplied or divided. In a few seconds back would come the answer.[5]

If this type of system for routine, complex calculating operations could be handled by human computers[6] sharing an automated remote central processing unit at Bell Labs, Berkeley reasoned that this system could be implemented for actuarial calculations at Prudential Insurance. He foresaw that the automatic calculator Stibitz developed for telephone operations could be profitably applied to business operations at insurance companies as well.

4. Berkeley, E., 1949, 130.

5. Ibid, 130.

6. See Grier, D. A., 2005, dust jacket: "Before Palm Pilots and iPods, PCs and laptops, the term 'computer' referred to the people who did scientific calculations by hand. These workers were neither calculating geniuses nor idiot savants but knowledgeable people who, in other circumstances, might have become scientists in their own right."

Stibitz publicly demonstrated their Complex Number Calculator and its remote operations at a meeting of the American Mathematical Society (AMS) and the Mathematical Association of America held at Dartmouth College in September 1940. The meeting was attended by a number of prominent mathematicians, including Harvard Professor George D. Birkhoff, John von Neumann from the Institute for Advanced Study at Princeton, and MIT Professor Norbert Wiener. Edmund Berkeley also attended this meeting during which mathematicians at Dartmouth College sent problems via telephone lines to the Complex Number Calculator at Bell Labs in New York. Stibitz and his team had developed their system to operate over long-distance telephone lines that enabled human computers to share a central processing unit (CPU) at a great distance from their input units. The CPU in New York solved the problems and quickly returned the answers to Dartmouth. This 1940 demonstration of computing via telephone equipment introduced possibilities of using a digital computer and binary code to speed up routine calculations for long-distance telephony. It also introduced the idea of remote terminal telecommunications using a shared CPU. Edmund Berkeley was intrigued by the possibility that this type of binary calculator could be applied to questions he worked with in the insurance industry—questions in natural language using a series of yes/no answers structured through the application of symbolic logic. He began to explore how this relay calculator brain, combined with symbolic logic, could be applied to actuarial calculations of risk at Prudential Insurance.

A Modern Method of Thinking

Berkeley had been interested in symbolic logic since 1927. As a sophomore mathematics student at Harvard, he heard a talk by Professor George Birkhoff which sparked an idea that stayed with him for the rest of his life—that there should be an algebra of language. Birkhoff directed him to *The Laws of Thought* by George Boole. There Berkeley saw "an algebra dealing with things like classes and statements, and operations like AND, OR, NOT" and this "opened wide for [him] a most exhilarating vista—the possibility that all the language of thought could really become calculable like mathematics."[7] Long before the first electronic computers, Berkeley saw symbolic logic as a system for helping people make correct decisions about social questions using natural language. These problems would include ideas not in numerical formulations, but phrased as sentences, propositions, assertions, implications, truths, or falsehoods. While he was studying at Harvard in the late 1920s, Berkeley decided that he would

7. Berkeley, E., 1959, iv.

take up Lewis Carroll's unfinished project for popularizing symbolic logic. After seeing the calculator Stibitz built from telephone relay switches, Berkeley realized that by combining symbolic logic and this machine using binary notation, he could realize his ambition to introduce a modern method of thinking through the application of symbolic logic.

When Berkeley graduated from Harvard in 1930, he gave a talk on "Modern Methods of Thinking" at the English commencement exercises.[8] In this address, he described "the methods of clear and rigorous thinking" from Aristotelian logic and analogy in ancient Greece to the scientific method and mathematics of the early 20th century. To these methods of reasoning, Berkeley added his contribution—the "merging of mathematics and logic" set out by Boole's symbolic logic. He stated that Boole "conceived the idea of a new system of symbolism for certain processes of reasoning which we are unconsciously performing over and over and over."[9] But whereas Boole introduced this "new system of symbolism," it took others, such as Bertrand Russell and A. N. Whitehead, Lewis Carroll, E.V. Huntington, Giuseppe Peano, and John Venn, to develop it into a workable system. "They have defined number, order, and infinity; perfected Boole's symbolism into an amazing method of reasoning; and stated the foundations of mathematics, logic, philosophy and the methods of thinking."[10] Berkeley predicted that an "atomic theory of reasoning" would extend Boole's work into the "orderly systems of truths" or "precise reasoning" that was needed in the 20th century to deal with the "growing complexity and interdependence of the social, economic and political forces of the whole civilized world."[11] In the face of growing social complexity, Berkeley believed that he could develop a precise system of reasoning—based on symbolic logic—that could help people make better decisions about the ill-structured problems that faced policy-makers, legislators, business leaders, and social activists. He hoped that by using a more mathematical and logical approach to making decisions about social questions, people could avoid problems such as large-scale war and economic collapse that he had already experienced in his lifetime.

One year before Berkeley's graduation talk, his professor George Birkhoff put forward related ideas in "Science and Spiritual Perspective: A New Philosophy." In this article, Birkhoff adopted Pythagoras' argument that "all things are numbers": "Historical and philosophical considerations indicate clearly that knowledge arranges itself

8. Berkeley, E., 1930.

9. Ibid.

10. Ibid.

11. Ibid.

naturally in a kind of hierarchy having five levels: the mathematical, physical, biological, psychological and social."[12] In other words, modern mathematics had "profoundly artistic qualities"[13] that could represent physical, biological, psychological, and social life in all its aspects. For Edmund Berkeley, mathematics was not only "rigorous reasoning," it was "magic, a wizardry of Arabia"[14] that could influence all other aspects of life. He was a romantic who initially wanted "a career as a creative mathematician" before his parents urged him into the more practical field of actuarial work.[15] He appreciated the aesthetics of abstract theories, as well as the artistic, humanistic, and fantastic sides of technical developments. He considered it his calling to help people make better decisions by applying symbolic logic to social questions.

In Berkeley's scheme, symbolic logic dealt with statements, classes, relations, and properties. Mathematics dealt with numbers, shapes, arrangements, and patterns. He distinguished between the types of questions these two approaches could address: "Mathematics concentrates on answers to questions like: "How much?" "How many?" "How far?" "How long?" Symbolic logic dealt with questions like: "What does it mean?" "Does this set of statements have conflicts or loopholes?" "What is the basis of this proof?""[16] Berkeley argued that logical questions were semantic (dealing with symbols and meaning), while mathematical questions were syntactic (dealing with order and arrangement). In this dichotomy, complex social questions fell within the realm of semantics and symbolic logic. Symbolic logic, not mathematics, offered a method for exploring relationships among groups of people and statements that were true or false. By systematically applying the deductive reasoning of symbolic logic, a person could determine the truth or falsehood of a series of statements. Complex social problems could be broken down into their elemental parts and the deductive process could be applied to arrive at the optimal path of action.

When Berkeley graduated in 1930, the high times of the Roaring Twenties had crashed, along with the passion for speculation that had inflated that decade's economic balloon. Frederick W. Taylor's principles of scientific management, introduced in 1911, had gained a larger following at the same time as Henry Ford's assembly-line manufacturing system standardized production for economic expansion. Industrial and mechanical engineers applied technological approaches to factory management, believing that scientific principles were a sounder basis for business and economic

12. Birkhoff, G. D., 1929, 157.

13. Ibid.

14. Berkeley, E., 1930.

15. Berkeley, E., 1955.

16. Berkeley, E., 1959, 2–4.

decision-making than human judgment.[17] Before the 1920s ended, scientific management principles would be extended from decisions about manufacturing in private factories to decisions about classifying people in military organizations.

When the U.S. entered World War I in 1917, psychologist Robert Yerkes introduced scientific intelligence testing for all Army and Navy recruits in order to establish "a fair and efficient military personnel system."[18] After the war, psychologists began applying intelligence testing in business, industry, and schools. In 1920, an article in *Harper's* articulated the connection between science, intelligence, and social welfare in this comment about people falling into the lowest two of the Army's five intelligence rankings: These people "lack the mathematical vision to reckon consequences. They do not know enough to vote with discrimination, or to choose honest men for leaders, or to keep their promises. Stupidity will kill any organization. It is the one dose fatal to democracy."[19] This writer expressed a hope that scientific methods, applied to human decision-making, would result in practical methods for increasing the probability that U.S. voters would make the best decisions for national security and prosperity. As Edmund Berkeley entered the workforce in 1930, he shared this belief that the application of symbolic logic to questions about social conditions would be the method for people to live in peace and prosperity, avoiding the horrors of the Great War from 1914-1918 and the widespread destitution following the stock market crash in October 1929.

Business and politics were not the only social arenas in flux in 1930, however. Public opinion was also changing about the role of the federal government in people's private lives. The negative relationship between government and business that had characterized the 1920s was giving way to a belief that government should have a positive role in shaping how people conducted business. In the early 1930s, there was little opposition to the New Deal idea that "the federal government was to be responsible for the condition of the labor market as a part of its concern with the industrial problem as a whole."[20] Political scientist Thomas Jenkin described this change in attitude toward the role of the federal government: "The concept that the function of government was to prevent exploitation by virtue of superior power has been replaced by the concept that it is the duty of government to provide security against all the major hazards of life—against unemployment, accident, illness, old age, and death."[21] The government had effectively entered the insurance business.

17. See Longo, B., 2000 for a more complete discussion of this transition to scientific management.

18. Kevles, D. J., 1968, 565.

19. Best, G. D., 2003.

20. Hofstadter, R., 1955.

21. Jenkin, T. P., 1945, 243.

The federal government's new role required bureaucrats to make decisions on complex social problems. If scientific management principles could be extended from factories to streets and homes, government officials believed that the unsound decisions could be minimized and social ills like the Great Depression could be avoided. In a 1935 article in *The Journal of Abnormal and Social Psychology*, educational psychologist and science teacher Victor H. Noll set out six habits of a person's "scientific attitude" that could be measured and taught to school children: "habit of accuracy in all operations, including accuracy in calculation, observation and report; habit of intellectual honesty; habit of open-mindedness; habit of suspended judgment; habit of looking for true cause-and-effect relationships; and habit of criticalness, including that of self-criticism."[22] In a 1947 book, Dr. Noll explained how these habits of a scientific attitude and social management could improve the lives of ordinary citizens and safeguard the country from economic and social ills:

> It is perhaps not too much to say that a great number of our present-day ills and troubles are directly traceable to false prejudices, and generally unscientific thinking. True scientific thinking would not have tolerated the fantastic orgy of speculation of the last decade, or the equally fantastic excesses in which those who benefited thereby indulged. Individuals who are in the habit of thinking "straight" do not invest in enterprises of which they know little or nothing; they do not mortgage their homes in order to buy expensive luxuries or to get rich overnight; nor do they look down on their friends and acquaintances who refuse to do these things. There are few, if any, of us from the most exalted to the most lowly who are not daily guilty of prejudiced, unscientific thinking and action. Is it any wonder, then, that our social organization, our political machinery, our economic structure, and even our educational programs are not more satisfactory or stable? As long as we place in positions of leadership and tolerate men and women whose acts are guided by the same unscientific thinking that put them there, we may continue to have and to expect wars, depressions, unemployment, Nazi triumphs, Scottsboro cases, and the like.[23]

Noll clearly saw a relationship between unscientific thinking and social ills. He represented an ongoing effort to apply scientific principles to human problems, an effort extending from Taylorism and scientific management in factory settings.

The intellectual climate in the U.S. in the 1920s and 1930s was favorable for attempts to deduce correct knowledge, truth, and optimal decisions through scientific methods of thinking and applications of mathematical logic. It was within this intellectual climate that Berkeley spent his years at Harvard and began to formulate

22. Noll, V. H., 1935, 145.

23. Noll, V. H., 1947.

his ideas about how symbolic logic could help people make correct decisions about classes of people. Berkeley would later argue that these social questions came within the purview of computer science, as well, because intelligent machines could use the 0-1, on-off, true-false electronic states to carry out the same deductive processes that were effective when human beings applied symbolic logic to social questions. And once humans knew the true and optimal path of action, he believed they would certainly take that path, thereby building better social systems and human relations.

Becoming an Insurance Actuary and a Husband

In 1930, Berkeley went to work as an actuarial clerk at Mutual Life Insurance on Nassau Street in New York City, where he computed "premiums, reserves, annuity rates, dividends, valuation factors, etc."[24] He soon longed to return to the scholarly world he had enjoyed at Harvard, feeling "as if the wide beautiful world of ivy and myrtle of two and twenty had been completely shut in by green carpets, mahogany desks, dim shafts of daylight between the skyscrapers, and excessively simple arithmetic."[25] His life consisted of "routine work by day and hard study by night"[26] to pass the professional actuarial examinations he needed to become a member of the Actuarial Society of America and the American Institute of Actuaries. He found this new chapter of his life to be "tiring."[27] After a couple of years at Mutual Life, Berkeley learned that he could apply for a Harvard junior fellowship, which would provide "three years of sparkling opportunity to study and investigate."[28] He sought support for his application from of one of his Harvard professors, E. V. Huntington, who responded with a friendly letter advising him to concentrate on his career and earning a living. Berkeley later recalled, "Since for some odd reason or other I was not appointed to be a Harvard junior fellow, it was rather easy for me to follow that advice, and I sought more than ever to become an actuary."[29] This job provided Berkeley with a good living and jobs were not easy to come by in the middle of the Great Depression.

Then in 1934 Berkeley inherited $8,000 from his aunt and he decided to leave the world of green carpets, mahogany desks, dim shafts of light, and simple arithmetic.

24. Berkeley, E. no date, CV.
25. Berkeley, E., 1955.
26. Berkeley, E., 1941.
27. Ibid.
28. Ibid.
29. Ibid.

He found himself "living once more instead of only surviving; it set [him] wondering how work could be combined with what you really wanted to do."[30] What Berkeley really wanted to do was to demonstrate and prove the effectiveness of symbolic logic for systematically addressing social questions. But in June 1934 Berkeley married Ruth Pirkle and he needed to earn a living.

Edmund and Ruth Pirkle Berkeley were certainly not an average couple for the 1930s. Ruth, born in 1899, was ten years older than her husband. She graduated in 1917 with a diploma in home economics from Georgia State College for Women near Augusta, Georgia—a school founded in 1889 to prepare women "for the demands of the new industrial age."[31] Pirkle continued her education at Agnes Scott College near Atlanta Georgia, earning her degree in 1922 and teaching biology at that school for nearly 10 years. During these years, Ruth Pirkle traveled to Columbia University in New York City to study geology during her summers. In 1932 she moved permanently to Manhattan and taught at Hunter College. She also continued her studies at Cornell Graduate School in Manhattan located at the Cornell Medical Center, pursuing a Ph.D. in biology.

Edmund Berkeley and Ruth Pirkle were married in June 1934 in the bride's hometown of Cummings, Georgia. The couple then set sail for a three-month honeymoon tour of Europe that included Norway, Italy, Greece, Turkey, and the Soviet Union. They spent about 6 weeks visiting 10 cities in Russia and studying for three weeks at the Anglo-American Summer Institute of the First Moscow University. Their studies included courses in sociology and economics, as well as tours of factories, clinics, museums, farms, homes, and a prison.[32]

During this trip, Ruth was offered an opportunity to study medicine in Cornell Medical School's Class of 1938. She later recalled, "Of course, I discussed it with my new husband. So on the honeymoon ship coming back from Europe, he sent a cablegram saying I would transfer from Cornell Graduate to Cornell Medical. He presented me with an accomplished fact."[33] When they returned to New York, Ruth and Edmund found an apartment in the Lower East Side at the newly completed Knickerbocker Village, bought some furniture, and started their new life together. Ruth was on her way to becoming one of the first female psychiatrists in the U.S.

30. Berkeley, E., 1955.

31. Anonymous, "About Georgia College," no date.

32. Berkeley, E., February 5, 1961.

33. Merriman, J. H., 1986.

Applications of Symbolic Logic in the Insurance Industry

Edmund went to work for Prudential Insurance as an actuarial clerk writing beneficiary clauses and computing policy changes. He found this position less claustrophobic because "the work was more interesting, and since the office was in Newark more sun came into the windows."[34] At this new job, Berkeley began applying his ideas from Boolean algebra to classes of people covered under insurance clauses, classes of policy changes, and classes of beneficiary settlements. In 1937, he published an article in *The Record of the American Institute of Actuaries* in which he argued for the utility of symbolic logic for handling such insurance problems as analyzing risk and developing rules for writing policies. Berkeley asked why Boolean algebra was not used more often, since it had been around for decades and was useful in solving business problems. One reason he found was that "much useful knowledge on all subjects remains hidden for years waiting for a popularizer. Another reason is the opposition of teachers of formal logic, who naturally will think of many reasons why their subject should not be largely displaced by a mathematical method. A third reason is that the common verdict on logic seems to be that it is useless, unconvincing, and dull."[35]

If popular opinion about logic was that it was dull and useless, Berkeley set out to change that situation. If Boolean algebra needed a popularizer, he would be that popularizer. He would fill Lewis Carroll's shoes to show how Boolean algebra and symbolic logic could help people make logical, correct business decisions about questions involving society-at-large. Carroll had shown how logic could be taught through games and visual representations of propositions in diagrams. He used truth tables to solve logic problems and trees for determining validity. Berkeley planned to extend these approaches to show how symbolic logic could be easily learned and productively applied.

When Berkeley came to the insurance industry, he was a proficient human computer who was further interested in applying symbolic logic to practical problems. Because insurance companies routinely deal with large numbers of people, risk, and classifications of risk groups, these companies tend to develop and employ the most current data processing techniques and equipment. In fact, insurance companies heavily rely on information technologies to produce the "information and documents that are its only products."[36] Berkeley believed that symbolic logic techniques could be integrated into insurance operations to streamline procedures for calculating risk.

34. Ibid.

35. Ibid.

36. Yates, J., 1993, 2.

In his 1930 Harvard commencement address, Berkeley emphasized that "concepts and their relations can with skill be maneuvered and marshaled into orderly systems of truths."[37] With this search for relations among concepts and his penchant for orderliness, Berkeley set out to modernize the information handling at Prudential. He knew the state of affairs facing human computers in the industry:

> When a man sits down at a desk to work on a computation, he has six things on his desk to work with: a work sheet; a desk calculator, to add, subtract, multiply, and divide; some rules to be followed; the tables of numbers he will need; the data for the problem; and an answer sheet. In his head, he has the capacity to make decisions and to do his work in a certain sequence of steps.[38]

This was the standard for mathematical work in the 1930s: the human computer, with knowledge of process and rules, aided by tools to facilitate the task. Berkeley sought to achieve improvements to this standard through rigorous applications of symbolic logic, leading to more precise human thinking processes, aided by desk calculators and punched card tabulating machinery. He wanted to "apply symbolic logic to human affairs."[39]

For several years, Berkeley worked in Prudential's Methods Division, focusing on work simplification. During these years, Berkeley had come to know insurance work from the perspective of an actuarial clerk functioning as the human computer for countless routine calculations. He also knew the insurance organization from the perspective of a systems planner. He was well aware of the immense demands for routine, accurate information that were inherent in an insurance company and the strains those demands put on human resources. He was also familiar with the punched card tabulating system Prudential used to help facilitate that workload. Because the insurance industry depended on large amounts of routine, accurate information as their profit-making product, good managers continually sought ways to decrease clerical costs while increasing the production of accurate information. Berkeley investigated how he could achieve these goals through "new applications of mathematics and logic to Company problems."[40]

Berkeley found his work at Prudential to be "very interesting, even to persons desiring to tread the frontiers of thought."[41] He found ways to apply symbolic logical

37. Berkeley, E., 1930.

38. Berkeley, E., 1949, 131.

39. Berkeley, E., February 13, 1943.

40. Berkeley, no date, CV.

41. Berkeley, E., 1941.

processes to insurance questions, many of which "owe their real difficulty and chief interest not at all to ordinary mathematical relations but instead to nonnumerical relations . . . [P]roblems involving insurance company rules classifications, and contracts, have been solved on the basis of Boolean algebra."[42] He devised and wired a control panel to carry out symbolic logic operations on the tabulating machine, "an application now recognizable as a predecessor of computer programming."[43] By 1941, Berkeley's applications of symbolic logic to insurance problems were being officially supported at Prudential. Along with one co-worker, he was assigned to develop these applications as part of his job in the Methods Department. They first developed a "dictionary of fundamental concepts and expressions," after which they worked on "an algebra for handling operations with electric accounting punched cards."[44] Berkeley was finally in a position to demonstrate how symbolic logic and Boolean algebra could be fruitfully applied to insurance company operations on a large scale, even using the punched card technology that was an insurance industry standard at that time.

Prudential had been heavily invested in punched card technology for nearly 50 years when Berkeley sought to introduce new methods of calculation there. In 1891, Prudential had been the first business customer for the Hollerith punched card tabulators when it installed two of these machines only one year after their successful public debut in the 1890 U.S. census.[45] Shortly thereafter, Prudential actuary John K. Gore had improved the sorting capabilities of the Hollerith machine and designed a new card perforating and sorting machine with his brother-in-law who was a mechanical engineer. In 1895, Prudential installed its own proprietary punched card machinery, which "introduced mechanical sorting and was the first punched-card machine to be run by an electric motor."[46] After the Gore system failed to meet Prudential's growing information processing demands, the company introduced IBM punched card equipment in 1935[47] for statistical and actuarial work. This equipment was later extended into the premium department when sorting by name became possible.[48] Data from 25 million policies needed to be translated from the Gore system's 45-column card into the IBM 80-column card, verified, and compared to the original data. Conversion to

42. Ibid.

43. Yates, J., 2005, 120.

44. Berkeley, E., 1941.

45. Campbell-Kelly, M. 1990, 135–136.

46. Heide, L., 1997; 2009, 44. Also see Yates, J. 2005.

47. Olmstead, B. E., no date.

48. May, E. C. & Oursler, W., 1950.

the IBM machines took five years and was completed in late 1940. Prudential retired its last Gore machine at the beginning of 1938. IBM continued to improve their punched card equipment through the 1950s, often in collaboration with their large insurance customers,[49] yet questions concerning how to handle large amounts of information and large volumes of calculations were an ongoing part of life within Prudential and other insurance companies.

49. Yates, J., 1996.

2

Navy Assignment at the Harvard Computation Lab, 1944–1946

Secrecy is best understood as a form of regulation.

—Daniel Patrick Moynihan[1]

Even while Prudential completed its conversion to IBM data processing equipment and Berkeley used symbolic logic to develop actuarial procedures that relied on this equipment, the possibility of another world war was becoming a reality for people in the United States. When war was declared after a Japanese air attack on the U.S. Navy base at Hawaii's Pearl Harbor on December 7, 1941, Prudential's organization, information processing machinery, and personnel were pressed into wartime service. The company's press was used to print military maps on rayon acetate to help pilots escape if they were downed behind enemy lines. Prudential employees packed thousands of aerosol containers with DDT for jungle fighters and assembled small parts for walkie-talkies. Prudential statistical personnel accounted for 400,000 New Jersey registered voters, enabling them to cast absentee ballots in the 1944 presidential election. Prudential President Franklin D'Olier and hundreds of employees studied the effectiveness of Allied bombing campaigns on enemies' economies and war efforts. Two million punched cards were prepared and processed to analyze the details of 150,000 attacks on 40,000 European targets. A 208-volume report resulting from their

1. Moynihan, D. P., 1956/1996.

efforts was completed in 1945, too late to affect the bombing campaign. It was influential, however, in convincing the White House and Congress to restructure military organization after the war.[2]

Berkeley took a leave from Prudential in 1942 to go on active duty as a lieutenant with the Naval Reserve, initially working in an office of the Resident Inspector of Naval Material in Newark, New Jersey "reporting and expediting orders for programs of mass construction of certain Navy vessels."[3] In his new role as a Navy officer, Berkeley initially struggled to supervise the four women clerks in the Resident Inspector's office.[4] He felt he was not communicating with them to get their cooperation to implement changes in ordering procedures. He especially met resistance from one clerk and tried to anticipate and plan for any possible situations between them. But he was not satisfied with his own performance managing his staff. Away from the confines of his work at Prudential and faced with his limitations as a manager, Berkeley thought obsessively about what he would do after the war. He considered the possibility of leaving Prudential and starting his own business and worked out these thoughts in writing to clarify his plan: "Proposal: After the war, devote your life to writing, speaking, and working in the subjects in which you are most interested: mathematics; economics; sociology; labor; politics. Live as economically as possible; use your whole time to make a good contribution to these subjects."[5] The prospect of devoting his life to social activism appealed to the idealist in Berkeley. But he was now the father of a baby girl Laura and he needed to consider how his plans would affect family finances: "How about Laura and Ruth? You have enough resources to keep them for a couple of years. By the end of that time you should be established as a writer, and be able to make some of that writing pay something."[6] But just in case this plan would not work, Berkeley also thought about becoming a consulting actuary,[7] and meticulously weighed the pros and cons of these propositions in orderly lists and memos to himself.

Berkeley especially considered devoting his life to the labor movement rather than continuing to pursue a middle-class life:

2. Accounts of Prudential's activities during World War II can be found in Carr, W. H. A., 1975; and May, E.C. & Oursler, W., 1950.

3. Berkeley, E., no date, CV.

4. Berkeley, E., August 1, 1943 and Berkeley, E., June 13, 1943.

5. Berkeley, E., February 13, 1944.

6. Berkeley, E., June 17, 1942.

7. Berkeley, E., February 13, 1944.

> I want to help build the century of the common man . . . to build socialism or communism, to use Lenin's words. I want to defeat the vested interests, the private ownership of means of production requiring thousands of workers, racial intolerance, oppression of human beings by other human beings. . . . [I]t would be so intensely satisfying scientifically—to see the social organization of the Soviet Union and the technical organization of the United States spread through the world.[8]

After seeing Soviet life first-hand on his honeymoon and studying its foundations, Berkeley believed that some combination of capitalism and socialism could take the best of each system and create a new third way to improve people's lives. It was a radical thought, but he wrote himself an encouraging note: "You have been a conservative in your youth. Now be a radical in your middle age."[9]

Berkeley also considered writing popular articles or a book on "aspects of mathematics, science, language, economics"[10]—areas in which he felt he had some expertise. Objections he posed against this idea were that his "main aim is to put forth . . . ideas about changing society, and the proposal is off the main path" and that "[w]riting for publication in a magazine means modifying your ideas to agree with the policy of the magazine."[11] He also posed reasons to favor this idea: "If your articles are accepted, you will gain an audience. If your articles are read and studied, they will spread knowledge."[12] While thinking about his post-war career, Berkeley had one pressing concern: "What should I do to make sure of mental health? to avoid psychological troubles, troubles with your personality? to save yourself from having to go to a mental institution?"[13] At this time, Dr. Ruth Berkeley was practicing medicine with psychiatric patients at New York Hospital, so Edmund was familiar with psychiatric symptoms and treatments, even if they were not considered to be mainstream medicine by most people at that time. The personal questions, career options, and political choices that Berkeley weighed would have significant implications for his career after the war.

Berkeley decided to concentrate on writing and publishing as a way to put forward his ideas about social improvement and symbolic logic. For the new year of 1944, he recorded 19 resolutions, including two relating to his work as an author: "Write and submit for publication at least four articles on social subjects" and "at least two

8. Berkeley, E., June 17, 1942.
9. Ibid.
10. Berkeley, E., June 28, 1942.
11. Ibid.
12. Ibid.
13. Berkeley, E., November 7, 1943.

articles and/or books on scientific and mathematical subjects."[14] He also resolved to "Support the liberal, progressive movements as fully as I can."[15] Along those lines, he contributed to the National Council of American-Soviet Friendships, Inc., a New York City-based organization headed by Corliss Lamont that included among its supporters such varied luminaries as Maxwell Anderson, Prof. George Birkhoff, Charles Chaplin, Karl Taylor Compton, Aaron Copland, Albert Einstein, Learned Hand, Moss Hart, Lillian Hellman, Langston Hughes, Harold Ickes, Helen Keller, Fiorello H. LaGuardia, Maurice Maeterlinck, Thomas Mann, Paul Robeson, Leopold Stokowski, and Max Weber.

In March 1944, Lieutenant Commander Berkeley sought reassignment to a more research-oriented post where he could use his mathematical skills for projects concerning "actuarial problems, International Business Machine and other computing machines, logic, cryptoanalysis, and similar fields."[16] In April, the Navy sent him to the Research and Development Division in the Navy Bureau of Ordnance in Washington, D.C. for five weeks to study new developments in ordnance. He was then transferred to the Dahlgren Naval Proving Ground to prepare for an assignment at the Harvard Computation Laboratory where he would work on the development of a second relay calculator, the Mark II, while also operating the earlier Mark I calculator. Dahlgren had contracted with Harvard University to produce the Mark II and the plan was for Berkeley to work on it at the Harvard Lab, then return to Dahlgren with the Mark II to work on trajectory problems. Berkeley was enthusiastic about his new assignment as liaison between Dahlgren Proving Ground and Harvard Computation Lab: "[T]here is hardly anything I would rather do, for it is right on the frontiers of mathematics, symbolic logic, and calculating machines."[17]

Joining Aiken's Crew

In late summer 1945, Berkeley was reassigned to the Harvard Computation Lab to report to Commander H.H. Aiken, Officer-In-Charge of the Bureau of Ordnance Computing Project. When Berkeley arrived, the Mark I had been completed by IBM, shipped to Harvard, and installed in the lab. This machine had been the brainchild of Howard Aiken in 1936 while he was working on the design of vacuum tubes as a Harvard University graduate student in physics. He needed to solve a series of nonlinear differential

14. Berkeley, E., January 2, 1944.

15. Ibid.

16. Berkeley, E., March 20, 1945.

17. Ibid.

equations that were tedious to calculate by hand and were not suited for Vannevar Bush's Differential Analyzer analog computer at MIT. Aiken wrote a proposal for a digital calculator and presented it to the Physics faculty at Harvard, but it was not seriously considered. Aiken continued to pursue the idea of developing this large-scale digital calculator and in 1937 sent his proposal to IBM. With the support of IBM's chief engineer James Bryce, Aiken began working informally with IBM to develop what became the Mark I computer. Aiken attended an IBM training school to learn about their existing machines and in early 1938 went to IBM's Endicott Laboratory in New York to work with a team of their senior engineers to develop his large-scale digital calculator. In 1939, IBM approved $100,000 to construct what they called the Automatic Computing Plant and what Aiken would call the Mark I. Aiken continued with the project as a consultant at IBM's Endicott facility until he was called to active military duty in 1941 as the Commanding Officer of the Yorktown Naval Mine Warfare School. Aiken maintained contact with his project through Robert Campbell, then a physics graduate student, who replaced him as the liaison between IBM and Harvard. But without Aiken's presence to spur progress, the project lost momentum within IBM and became "just one of many special development projects for the armed forces."[18] The first test problem was run on the machine in 1943.

In May 1944, the Mark I became operational at Harvard, mainly producing mathematical tables. In that same month, Howard Aiken was transferred from his teaching position at the Naval Mine Warfare School to the U.S. Navy's Bureau of Ships, which oversaw the operations of the Harvard Computation Lab in the basement of Cruft Hall. Lieutenant Commander Aiken was put in charge of the lab, with a core naval staff of Lieutenant Grace Hopper, Ensign Robert Campbell, and Ensign Richard Bloch. Aiken and IBM planned a public dedication ceremony to publicize the installation of "Harvard's Robot Super-Brain."[19] The dedication, which took place on August 7, 1944, became a sour turning point in relations between Aiken and IBM. The Harvard press release announcing the dedication named Aiken as the sole developer of the Mark I, ignoring IBM's contributions to designing and building the machine. IBM President Thomas Watson, upset by this slight, threatened to return to New York without attending the dedication ceremony. Upon reconsideration, Watson attended the dedication to officially present the IBM Automatic Sequence Controlled Calculator as a gift to Harvard University. Robert Campbell recalled, "The feelings between Watson and Aiken were particularly bitter, and were never fully healed. I should say at this

18. Campbell-Kelly, M., & Aspray, W., 1996, 72.

19. Lal, G., B., 1944.

point that many of us on the staff of the laboratory also felt that IBM had not been treated fairly."[20]

The Mark I ran nearly around the clock to solve war-related problems for the US Navy, including "studies of magnetic fields associated with the protection of ships from the destructive action of magnetic mines, and mathematical aspects of the design and use of radar."[21] Staff from the Los Alamos Laboratory used the Mark I to study the design of the atomic bomb under development there. The recurring problem that had plagued technology developers since the 1930s was now slowing the A-bomb developers: the need to make faster calculations than was possible using human computers. At Los Alamos, "mechanical calculators tended to break down under heavy use by physicists and had to be shipped back to the manufacturer until physicists Richard Feynman . . . and Nicholas Metropolis . . . learned to repair them. . . . Dana Mitchell, whom Laboratory Director J. Robert Oppenheimer had recruited from Columbia University . . . recognized that the calculators were not adequate for the heavy computational chores and suggested the use of IBM punched-card machines,"[22] a process that took weeks to complete an implosion simulation problem.

In the meantime, Princeton mathematician John Von Neumann, a consultant to the Los Alamos Lab, suggested that the Los Alamos team work with Aiken to test an unclassified problem on the Mark I. In August 1944, von Neumann sought help from the Harvard Computation Lab staff to calculate a nonlinear partial differential equation for detonating plutonium. When von Neumann first started working at the lab, Mark I operator Richard Bloch commented that he "didn't know a computer from a tomato basket."[23] Grace Hopper observed that von Neumann would initially "go over and peer at the printouts on the typewriters,"[24] apparently unsure of how the machine actually worked. The Mark I calculated the results with improved accuracy over human computers, but the mechanical Mark I worked more slowly than the electronic ENIAC machine being developed by John Mauchly and Presper Eckert at the University of Pennsylvania.

The Mark I operators did not press von Neumann for details on the spherical shock wave problem they ran, but they suspected that it had to do with atomic fission related to the development of an atomic bomb. By October 1944, von Neumann reported to

20. Cohen, I. B., 1999, 59.

21. Cohen, I. B., 2000a, 116.

22. Los Alamos National Laboratory, no date.

23. Williams, K. B., 1999, 103.

24. Ibid.

the Applied Mathematics Panel (AMP) that Aiken "put the problem on and has shown more direct interest than expected."[25] On July 16, 1945, the first plutonium bomb was exploded on the desert near Alamagordo, New Mexico; on August 9, the "Fat Man" plutonium fission bomb was dropped on Nagasaki, Japan. The Harvard Lab staff did not learn positively that their work had contributed to the design of the atomic bomb until after the war had ended.[26]

When Berkeley joined Aiken's lab, the naval staff had grown to include Lieutenant Commander Hubert Arnold, Lieutenant Harry Goheen, Lieutenant (jg) Brooks Lockhart, and Ensign Ruth Brendel, four Specialists First Class to operate the machine, a Yeoman First Class to handle Navy administration, and a civilian secretary Robert Hawkins.[27] Lieutenant Commander Berkeley was assigned to help design Mark II, the next generation of relay computer that would be used to calculate accurate firing tables. As a human computer, Berkeley had been solving ballistics problems and calculating firing tables at Dahlgren Proving Ground. But given that the war had spread to so many areas of the world, each with different atmospheric and topographic conditions, the need to calculate accurate firing tables for all the different weapons had outstripped the capabilities of human computers.

The Mark II worked with ten decimal digits and was one of the first machines to use the binary coded decimal (BCD) coding that Stibitz had developed at Bell Labs. It also used floating-point arithmetic, which Stibitz had also introduced in calculating machines at Bell Labs.[28] At Harvard, Berkeley worked on the early stages of design for the Mark II calculator, but left active military duty in July 1946, while the Mark II was still in development. While on this assignment, Berkeley reported that he applied "symbolic logic to save about $4000 of relays in the design."[29] The Mark II was built and tested during 1946 and 1947, was shipped to Dahlgren Proving Ground in February 1948, and was running there in September of that year. By that time, Berkeley was back at Prudential, advocating for the integration of electronic computers into insurance company operations and writing a book about computers aimed at the average American reader—*Giant Brains or Machines that Think*.

25. Ibid.

26. Cohen, I. B., 2000a, 116.

27. Robert Hawkins was originally a machinist at Harvard, who followed the Mark I through its development at IBM and its subsequent operation at the Harvard Computation Lab.

28. Ifrah, G., 2001, 209–214.

29. Berkeley, E., no date, CV.

Conflict inside the Harvard Lab

While Berkeley was at the Harvard Computation Lab, he felt caught up in a web of conflicts that were both structural and personal. In fact, these conflicts that Berkeley experienced were symptomatic of tensions among military units, federal agencies, private businesses, universities, and the people working in all these places. For example, one area of tension arose from decisions about who would oversee development of the computers at Harvard University. Although the Mark I computer was developed by IBM, it was housed on the Harvard University campus and its operation was controlled by the U.S. Navy. This uneasy arrangement reflected a long-standing animosity between Aiken and Harvard administrators that had begun when Aiken was a graduate student in the Physics Department.[30] As Commanding Officer of the Yorktown Naval Mine Warfare School, Aiken strengthened his ties with the Navy, "urg[ing] his superiors that it would be more beneficial for the Navy, rather than Harvard, to assume responsibility for the machine, and that he should be named the project's acting commander."[31] Navy brass decided to have their Bureau of Ships take responsibility for the operations of the Mark I, to pay rent to Harvard, and to staff the operation with Navy personnel.

In June 1944, Aiken was promoted to commander in charge of the Harvard Computation Lab. "It is not clear now Aiken managed to obtain his transfer nor by whom it was authorized. In an interview years later, Aiken was to say that one day he received a telephone call at Yorktown from a 'high ranking naval officer' who wanted to know why he was not running his calculator. He replied that he was just following orders. Within hours those orders were changed and Aiken was on his way back to Cambridge to become, as he put it, 'the only man in the world who was ever commanding officer of a computer.'"[32] Aiken took command of the lab with its unconventional reporting structure that included the Navy, the civilian National Defense Research Committee (NDRC), and Harvard University. "While Howard Aiken technically reported to Commander David Ferrier, of the nearby Harvard Radio Research Laboratory, and to Commander Eugene Smith at BuShips, he also received instructions directly from the NDRC's Applied Mathematics Panel[33] on projects to be assigned to his lab. . . . Aiken

30. For a more complete recounting of this relationship between Howard Aiken and Harvard University, see Cohen, I. B., 200b.

31. Beyer, K. W., 2012, 78.

32. Williams, K. B., 1999, 100.

33. Warren Weaver was the chair of this NDRC panel. He had also been one of Aiken's calculus professors when Weaver was on the faculty at the University of Wisconsin, where Aiken earned his undergraduate degree in electrical engineering. See Cohen, I. B., 2000b, 14.

was essentially autonomous, running his nominally Navy facility in his own idiosyncratic way."[34] The staff was a "crew," they wore the Navy uniform of the day, and were on duty around the clock. Military protocol was followed and the lab was guarded day and night by armed Navy guards.[35]

The unconventional reporting relationship that included the Harvard lab, the federal government and the military was not unique during World War II. It was the brain child of Vannevar Bush, who President Roosevelt named to establish the National Defense Research Committee (NDRC) "to coordinate, supervise, and conduct scientific research on the problems underlying the development, production, and use of mechanisms and devices of warfare."[36] Bush formed his nine-member NDRC team, which included Dr. Karl T. Compton, president of MIT; Dr. James B. Conant, president of Harvard University; Dr. Frank B. Jewett, president of the Bell Telephone Laboratories; and Rear Admiral Harold G. Bowen, director of the Naval Research Laboratory at Anacostia, D.C.

Rather than building stand-alone NDRC labs, Bush contracted with "colleges, universities, scientific institutions, and industrial laboratories"[37] to conduct studies relating to warfare and report results to the NDRC—a civilian, federal government, and military entity. This scheme became known as "federalism by contract,"[38] which shifted decision-making about war and technology from the federal government or military into the hands of unaccountable experts and "freelance 'brains.'"[39] Upon hearing of this arrangement, Harvard's Conant wrote, "I shall never forget my surprise at hearing about this revolutionary scheme. Scientists were to be mobilized for the defense effort in their own laboratories. A man who we of the committee thought could do a job was going to be asked to be the chief investigator; he would assemble a staff in his own laboratory if possible; he would make progress reports to our committee through a small organization of part-time advisers and full-time staff."[40] "Great care [was] taken to ensure proper secrecy in regard to operations."[41]

In 1942, the Applied Mathematics Panel (AMP) was established under the NDRC, at that time headed by Harvard President James Conant. The Panel's mandate was

34. Williams, K. B., 1999, 94.

35. Williams, K. B., 1999, 98.

36. National Defense Research Committee, 1940.

37. Ibid.

38. Zachary, G. P., 1999, 115.

39. Ibid, 116.

40. Qtd. in ibid., 115.

41. National Defense Research Committee, 1940.

to "help with the increasingly complex mathematical problems that were assuming importance and with those other problems that were relatively simple mathematically but needed mathematicians to formulate them adequately."[42] Vannevar Bush's close friend[43] Warren Weaver, who had been Professor and Chair of the Mathematics Department at the University of Wisconsin until 1934, served as the Panel's Chief. While Aiken was earning his undergraduate degree in electrical engineering at the University of Wisconsin, Weaver was his calculus teacher. Aiken had kept in touch with Weaver over the years, corresponding with him while Weaver was Director of the Division of Natural Sciences at the Rockefeller Foundation after leaving the University of Wisconsin. The AMP assigned projects to NDRC labs and Weaver's familiarity with Aiken served the Harvard Lab operations well. For example, in October 1943, staff at Dahlgren Proving Ground expressed interest in George Stibitz's relay device for computing ballistics tables. They considered contracting with the Bell Laboratory to construct a machine for the Navy. Before committing to a contract, however, the Navy requested the AMP to survey the field of possible calculating machine providers. AMP head Warren Weaver knew that Aiken had nearly completed the Mark I and directed that the Harvard Computation Lab be included in the survey. "Very likely, the Navy-initiated survey of computational equipment, and the attention thus focused on the Mark I, combined to spur the Navy's takeover of the Harvard machine under its creator, Aiken. Moreover, the eventual result of the survey was that Aiken won the Dahlgren contract too, the Navy paying 'a quarter of a million dollars for a machine like the Harvard machine' to be constructed."[44]

Although the Harvard Lab was run like a military operation, Robert Campbell recalled that the lab's organizational structure "was at first rather informal. . . . Aiken was very much a hands-on manager and participated directly in much of the work. . . . [He] tended to interface with everyone directly. . . . Aiken was very demanding of himself and of everyone else on the staff, but he was very supportive of anyone who he felt was doing a good job. He could also be very cutting to someone who he felt was not."[45] To relieve the strain of long working hours and tight military discipline, lab crew members indulged in what Campbell called "great kidding around."[46] Grace Hopper recalled they "played all kinds of tricks" on the lab's executive officer, Lieutenant Commander Hubert Arnold, while Aiken was out of town. Upon his return, Arnold complained to Aiken that the crew had been insubordinate. "I admit it, we

42. Rees, M., 1980.

43. Zachary, G. P., 1999, 93.

44. Williams, K. B., 1999, 100.

45. Cohen, I. B., 1999, 60–61.

46. Williams, K. B., 1999, 102.

were," Hopper remembered. "We were insubordinate I guess, except he just asked for it, I swear he did."[47] Aiken reassigned Arnold to conduct library research on numerical analysis and applied mathematics. Hopper became Aiken's second-in-command.[48]

Working conditions at the Harvard Computation Lab were exhilarating to some and oppressive for others. People were either insiders or they were relegated to the margins. Harvard historian I. Bernard Cohen, who interviewed Aiken extensively, described him this way: "Aiken was a giant of a man. . . . Standing erect at six feet and some inches tall, he towered over most of his students and colleagues. . . . [H]e had piercing eyes crowned with huge beetling and somewhat satanic eyebrows."[49] Cohen further characterized Aiken's personality traits that went into shaping life in his lab: "Aiken related to people in extremes. When he met you, you were almost at once graded, placed at the top of his scale or the bottom—there was never a middle ground. On a scale from one to ten, Aiken would rate you as a zero or an eleven. People reacted to Aiken in the same way. His students and associates either admired him and established a friendly relationship or found him to be 'impossible.'"[50] One of the lab's original crew members, Frederick Miller, agreed: "He was one of these individuals that you are either with him or against him. If you were with him, why, there was nothing he wouldn't do for you. If you were against him, why, there was nothing good that you could do."[51] Anthony Oettinger, who worked on machine translation in the lab after the war ended as a junior at Harvard, found a "welcoming environment. . . . It was fantastic. It was like one big family."[52] Robert Hawkins, who worked with Aiken in the lab for more than ten years, said he "got along with him fine," but "he was a hard man."[53] Richard Bloch, one of the original lab crew members, described Aiken as a "tough hombre."[54] Grace Hopper, who upheld Aiken's discipline for lab operations, found him to be "a tough taskmaster" who "taught us discipline."[55] Nevertheless, she considered him an "excellent leader" and the person she most enjoyed working for in her entire career.[56] Aiken returned her admiration, saying, "Grace was a good man!"[57]

47. Beyer, K. W., 2012, 87.

48. ibid

49. Ibid.

50. Cohen, I. B., 2000a, 108.

51. Beyer, K. W., 2012, 81.

52. Akira, A., 2006.

53. Williams, K. B., 1999, 102.

54. Ibid.

55. Hopper, G., 1999, 191–192.

56. Williams, K. B., 1999, 102.

57. Beyer, K. W., 2012, 88.

While working in Aiken's lab, Berkeley believed that he was reporting to the Navy Bureau of Ordnance rather than to Commander Aiken, and wrote a series of progress reports to the Ordnance Officer at Dahlgren Proving Ground. In October 1945, Berkeley reported on the first weeks of his temporary assignment and included recommendations for transitioning operations of the machine from Harvard to the Dahlgren Proving Ground. He also reported on the "progress of the design and construction of the Dahlgren calculator" finding it to be "encouraging." He continued, "The staff of the Ordnance Computing Project contains a number of extremely able men and women, Navy and civilian, and the work is being pursued with remarkable energy, enthusiasm, skill, and cooperation. Comdr. H. H. Aiken provides vigorous yet friendly direction, and exceptional engineering and mathematical genius."[58]

Robert Campbell characterized Berkeley's relationship with Aiken as a "built-in clash of personalities. . . . At one point Ed suggested to 'the Commander' that he should read *How to Win Friends and Influence People*, but it is doubtful whether Aiken took his advice."[59] Berkeley got off to a bad start at Aiken's lab, where "Hopper and the crew saw him as a civilian computer"[60] rather than a Navy man. Hopper recalled, "He got scared to death of Aiken so he started sending me little notes."[61] Berkeley obsessively recorded notes all his life, and this habit appeared to exhibit a nervous weakness to the crew in Aiken's lab. "This drove Aiken crazy," Hopper recalled, "so Aiken wouldn't let him take notes, and so he would go out to his desk and make notes as soon as he finished talking to the commander. . . . We used to plague the hell out of Berkeley."[62] In addition to taking notes, Berkeley obsessively date stamped documents and carried his date stamp with him while he was working. Aiken's lab crew found this amusing. Hopper recalled that to play a prank on Berkeley, "they very carefully stole his date stamp, and went up and date-stamped the whole roll of toilet paper in the men's room. Berkeley threw a fit when he found his precious date stamp."[63] Berkeley and co-worker Harry Goheen found working conditions in the lab to be "repressive."[64] Berkeley sought to extricate himself from Aiken's direct authority, while still working in the lab.

58. Ibid.

59. Adams, J., 1988.

60. Beyer, K. W., 2012, 164–165.

61. Ibid, 164–165.

62. Ibid, 164–165.

63. Ibid, 164–165.

64. Ibid, 164–165.

In a May 1946 memo to the Ballistics Officer at Dahlgren Proving Ground, Berkeley continued to insist that his assignment was to install and operate the Mark II at Dahlgren and that his assignment with Commander Aiken at the Harvard Lab was temporary. When he received orders from Dahlgren to visit the Special Devices Depot of the Office of Research and Inventions in New York, this assignment appeared to support his contention that he reported to the Dahlgren officers, not to Aiken. On May 27, 1946, Berkeley prepared two memos as a result of May 11 and 13 visits to the Special Services Depot of the Office of Research and Inventions (ORI). The subject of one memo was “Electronic Calculator Developments at Institute for Advanced Study (IAS), Princeton, and at RCA, Camden” which included technical details of an “electronic digital calculator” being developed by the IAS (Von Neumann and Tookey), the ORI (Wakelin), RCA (Zworykin), and the War Department in Washington (Goldstine).[65] The subject of the second memo was “Electronic Digital Calculator Development at Mass. Institute of Technology,” which included information about that project.[66] During a visit to the ORI Boston Branch on May 3, 1946, Berkeley learned that the ORI had signed a contract with the MIT Electrical Engineering Department Servo-Mechanisms Laboratory “to build for the Navy one or more electronic digital calculators, for application in attack and defense problems of swarms of guided missiles” under the supervision of Jay Forrestor and Gordon Brown.[67]

On May 27, 1946, Berkeley also delivered a confidential 11-page memo, on U.S. Naval Proving Ground letterhead, to the Experimental and Ballistic Officers at Dahlgren Proving Ground. The subject of this memo was “Bureau of Ordnance Calculator Project at Harvard University under Commander H. H. Aiken.” In his assignment as liaison between the Proving Ground and the Aiken’s lab, Berkeley felt it was his duty to report on working conditions in the lab and recommend changes that would improve those conditions. In his usual, thorough, and detailed style he noted, “It is an unfortunate fact that there are a number of . . . conditions which are not good. Also, there are more than a few danger signals that if these conditions are not remedied, the quality of the calculators and the quality of the staffs to operate them may be seriously lowered.”[68] Berkeley began by praising Aiken’s “energy, imagination, stimulation and genius.” But after that brief praise, he went on to list eight problems with lab operations in damning detail:

65. Berkeley, E., May 27, 1946.

66. This project at MIT became Project Whirlwind. See Edwards, P. N., 1996.

67. Berkeley, E., May 27, 1946.

68. Ibid.

Educational opportunities were promised to lab staff members, but promises were not kept. Berkeley reported that Aiken promised at least three people—Lt. Robert Campbell, Lt. Richard Bloch, and Robert Wilkins—that they could take Harvard courses to complete or earn degrees. After making these promises, Aiken would not allow staff members to change their schedules so they could take courses, even after VJ Day when World War II ended and work schedules eased. Berkeley recommended, "It would seem that at a computation laboratory under the auspices of a university, it would be possible for dependable arrangements to be made whereby a limited amount of time off could be taken from the project in order to attend classes at the university,"[69] with time off being made up later. Berkeley predicted that if Aiken's promises to the staff members were not kept, they would leave the lab and delay completion of the Mark II.

Opportunities for professional contacts were denied to lab personnel, even when outside guests visited the lab. Berkeley specifically noted, "When men of professional importance visit the Laboratory, they are not introduced to any of the staff, except to those who are to work on the problems which they may be bringing with them. In addition, very little opportunity is allowed to occur for even the renewal of existing acquaintanceship; the visitors are whisked away." In addition, from August 1945 to May 1946, at least three professional meetings were held at Harvard or MIT, but lab staff members were not permitted to attend these meetings, even on their own time. Berkeley noted, "The individual instances of such restrictions as these are relatively unimportant, but taken all together they produce a pattern—a feeling of being hermetically sealed off from the outside world, and a disinclination for men who desire professional contacts to remain in the laboratory."[70] Berkeley recommended that staff members be encouraged to attend professional meetings, within reason, and to come in contact with visitors to the lab.

This "hermetically sealed" atmosphere in the lab meant that ideas from other projects did not make their way into Aiken's lab operations. Berkeley reported that between February and May 1946, "only one trip—by Lt. Grace M. Hopper . . . to the calculator ENIAC for two days—has taken place. . . . Of course, original thinking is greatly to be praised, but there are pitfalls—waste of time and money—waiting for those hardy souls who do not learn from the experience of others." Berkeley recommended that "investigation of the work of other persons and groups in the field of computing machinery" be encouraged.[71]

69. Ibid.

70. Ibid.

71. Ibid.

Time off for holidays was "frequently" announced "only at the last minute with the result that planning is impossible."[72] Even after the war ended, Aiken did not allow holidays for lab workers, even when they were granted to other Navy personnel, Harvard staff, and people working in industry. Berkeley felt this uncertainty about time off, especially for religious holidays, was detrimental to lab morale.

Berkeley also noted that lab morale was negatively affected by longer working hours than comparable organizations. "The personnel on the project contrast their six day 44 hour work week, with the five day 38½ hour work week at all of Harvard except the computation laboratory, and with the five day 40 hour work week in nearly all Naval establishments in peace time, and the contrast does not lead to satisfaction." He recommended that "a shorter work week could not be well justified,"[73] especially with a low 5–8 percent breakdown rate on the Mark I operating around the clock.

Berkeley noted that Aiken's management generated "a number of other sources of friction," such as "varying instructions about the same task, at different times and to different people . . . bending one's energies to finish a task to meet a certain set deadline, only to observe that the deadline was fictitious . . . setting professional mathematicians at work on opaquing photographs (using a small paint brush and opaque liquid), not as a last minute stop gap but as a standard daily tasks, for the purpose of producing good photooffset masters cheaply for the printing press; resenting any suggestions however made—unless very skillfully presented as something previously thought of by the project director; taking such suggestions to be either criticisms from a source where there is no right to criticize, or else interference with the director's jurisdiction over the project; and many other little things which ordinarily would not be worth talking about but which accumulate from day to day without release." Berkeley felt that it was "hard to see any practical remedies for such matters as these."[74]

The absence of any grievance procedure for lab workers was one consequence of the murky reporting structure used to establish the lab. In Berkeley's estimation, "there is no provision for appealing any decision or ruling whatever made by the project director. No one at Harvard appears to have any substantial jurisdiction over the settlement of grievances at the Laboratory, and no one in the Navy likewise. . . . It was a direct result of the absence of a clearcut line of authority and responsibility for settling grievances that the following unfortunate chain of circumstances occurred, resulting in the severing of Lt. H.S. Goheen and the undersigned [Berkeley] from the project. . . . " Berkeley recounted an incident in December 1945 in which Lt. Goheen

72. Ibid.

73. Ibid.

74. Ibid.

was identified—with Aiken's recommendation—to be assigned to the Mark II installation at the Dahlgren Naval Proving Ground. Before finalizing this assignment, Lt. Goheen was to visit Dahlgren for "a couple of days" to learn more about his duties there. When Lt. Goheen asked for the time to visit, Aiken would not permit him the time until June 1946, which was after Goheen's assignment at Aiken's lab had ended. This arrangement would not allow Goheen to plan his next assignment before leaving Harvard and he could be lost to the Mark II project. Berkeley phoned Commander Morrin at Dahlgren about this situation and Morrin wrote orders to Aiken to permit Goheen to visit Dahlgren. Aiken saw the orders on May 6, after Goheen had left for Dahlgren. When Goheen returned to the lab on May 10, both he and Berkeley "were severed from the project. It is worth noting that what had happened in actuality, Lt. Goheen's trip to the Naval Proving Ground was exactly what the project director for the previous three months had agreed to arrange."[75] This episode with Lieutenants Goheen and Berkeley was one instance of a larger problem of "very high" staff turnover in the lab. Berkeley listed 11 people whom Aiken had asked to stay in the lab after the war, but who had left for other positions.[76]

Despite these problems with Aiken's management of the Harvard Computation Lab, Berkeley recommended that it was "definitely undesirable that there should be a change in project director. The vigor, energy, directness and intolerance of obstacles which make the problem of dealing with personnel difficult, are in many respects virtues in the struggle to wrest information out of the scientific unknown, and actually build scientific machinery of new kinds. In fact, it is probably a long and friendless experience of struggles and a tormenting fear of failure which leads to most of the conditions affecting personnel."[77] Instead of replacing Aiken as lab director, Berkeley recommended that he be "placed under some organ of the Navy or the University in which will reside the power to supervise the project in regard to personnel and to ensure the equitable and consistent carrying out of policies adopted regarding personnel." In Berkeley's estimation, Aiken had "little interest" in the details of supervising personnel; this change and clarification of reporting structure could allow Aiken to "put much more time, energy and concentration on details of science and engineering where he has much greater interest."[78] When Berkeley delivered this memo in May 1946, he wanted to be helpful to his superiors at the Dahlgren Naval Proving Ground, to ensure the successful installation and

75. Ibid.

76. Ibid.

77. Ibid

78. Ibid.

operation of the Mark II computer there. However, it is possible that others who read this memo saw resentment in Berkeley's recommendations.

Berkeley was not the only person to foresee trouble in Aiken's lab. In late August 1946, British computer developer Maurice Wilkes toured the Harvard Computation Lab after attending lectures at the Moore School at the University of Pennsylvania where he learned about the newly developed EDVAC electronic computer that operated with vacuum tubes and diodes instead of mechanical relay switches like the Mark I. The EDVAC could also store programs internally, unlike the Mark I which relied on rolls of punched paper tape for programming. At the Harvard Lab, Wilkes "was received by Howard Aiken and saw both the . . . Mark I grinding out tables and a new relay machine, the Mark II, under construction."[79] Wilkes brought up the subject of mercury delay-line memory being developed at the Moore School to increase calculation speeds. Aiken roared, "You are not committed to mercury memory, are you?" In remembering this exchange, Wilkes said, "I was a little afraid of Aiken."[80] To Wilkes, "Aiken now appeared to be one of the older generation, hopelessly trying to extend the technological life of relays while resisting the move to electronics."[81] Wilkes later remarked that Aiken, "having been a pioneer in one generation, was to prove an extreme reactionary in the next."[82]

79. Campbell-Kelly, M., & Aspray, W., 1996, 102.

80. Beyer, K. W., 2012, 83. See also Wilkes, M.V., 1985, 128 and 174; Wilkes, M.V., 1999, 216.

81. Campbell-Kelly, M., & Aspray, W., 1996, 102.

82. Wilkes, M.V., 1985, 128.

3 Establishing Open Communication Channels for Technology Development, 1945–1948

The measures taken during the war by our military agencies, in restricting the free intercourse among scientists on related projects or even on the same project, have gone so far that it is clear that if continued in time of peace this policy will lead to the total irresponsibility of the scientist, and ultimately to the death of science. Both of these are disastrous for our civilization, and entail grave and immediate peril for the public.

—Norbert Wiener

Berkeley left active military duty in July 1946, after working in the Harvard Computation Lab where John von Neumann brought unclassified, war-related "gas dynamical calculations"[2] to be run for his Los Alamos Lab work on nuclear implosion. Berkeley was one of the crew who worked on these calculations that contributed to the design of the Fat Man plutonium fission bomb dropped on Nagasaki, Japan in August 1945. The Allies—the U.S., Britain, France, the Soviet Union, and thirteen other countries—had won World War II, but the full cost of that war was only appreciated as time went on.

Like many of his fellow Americans, Berkeley began to better comprehend the human toll of World War II after detailed stories of human consequences were published after the war. In August 1946, the *New Yorker* magazine devoted an entire issue to "the telling of the effects of the atomic bomb dropped on Hiroshima" by following

1. Wiener, N., 1947, 46.
2. Cohen, I. B., 2000b, 164.

"the fate of six survivors" and describing their experiences.[3] Reporter John Hersey's 31,000-word first-hand account that accompanied survivors' stories vividly recounted the devastation and effects of this new weapon on ordinary citizens. In addition, Nazi atrocities became public through the International Military Tribunal held in Nuremburg from 1944–1946. Berkeley believed that mathematicians were misguided when they devised solutions to social problems that ended in mass destruction. He had worked on von Neumann's implosion problem at the Harvard Lab, which related to developing the complicated detonator necessary to build the Fat Man plutonium bomb. Berkeley realized that he had contributed to devastation like that described by Hersey in Hiroshima. He had used his mathematical expertise to help develop a nuclear weapon that could be made using relatively cheap plutonium as the fissionable material—a weapon that could be stockpiled in large numbers. But would this stockpile of nuclear weapons protect people or threaten human existence?

Berkeley came to believe that nuclear weapons, like the Fat Man he had worked on, threatened human existence rather than protecting it. In his estimation, he and other mathematicians should apply their efforts to engineer peace and solve "problems of society with the most correctness and the least trouble."[4] In order to help change the focus of applied mathematics and computer development toward more socially responsible outcomes, Berkeley contributed to organizations working for peace, like the anti-fascist National Council of American-Soviet Friendship. He also corresponded with its radical humanist chairman Corliss Lamont about the Council's activities to establish exchange programs and strengthen ties between the U.S. and the Soviet Union.[5] He participated in a late 1944 meeting of the Council in which supporters signed this message: "In this [American-Soviet] friendship lies not only the hope but the future of the world."[6] At this time, the Soviets and Americans were partners in fighting the fascist threat of the Axis powers—Germany, Japan, and Italy. These Axis countries saw Communism as a threat to their sovereignty through Soviet "commission of violence against . . . existing States by the exercise of all means at its command."[7] Asserting that Soviet Communism threatened "the general peace of the world," Germany and Japan signed an Anti-Comintern[8] Pact in 1936, with Italy join-

3. Hersey, J., August 31, 1946.

4. Berkeley, E., July 24, 1945.

5. Lamont, C., October 23, 1944.

6. Maland, C., 1991, 253.

7. Mushakoji, K. & von Ribbentrop, J., 1936.

8. The Comintern refers to the Communist International, an association of national communist parties founded in Moscow in 1919 to coordinate political efforts. In 1939, the Comintern took a

ing the Pact in 1937. In August 1939, German foreign minister von Ribbentrov and Soviet leader Stalin signed a mutual non-aggression pact, thus assuring that the Soviets would not oppose Hitler's nationalist plans to establish a new empire of "living space" or in Europe.

The question of who was threatening the peace of the world became clearer after German forces invaded and defeated Poland, Norway, Denmark, Netherlands, Belgium, and Luxembourg between September 1939 and June 1940. Britain and France declared war on Germany in September 1939. By October, Poland fell to a combination of German and Soviet forces, who divided the country between themselves. In June 1940, France signed an armistice, ceding the northern half of that country to German forces. By the following June, Germans had invaded Yugoslavia Greece, and the Baltic States. They then moved into the Soviet Union, violating the 1939 German-Soviet non-aggression pact and intending "to wage a war of annihilation against the Communist state."[9] In December 1941, Japan attacked Pearl Harbor, bringing the U.S. into the war. Within a week after that attack, Germany and Italy also declared war on the U.S. By 1943, war raged in Europe, North Africa, and the Pacific. Two U.S. atomic bombs were credited with ending the war in the Pacific in the summer of 1945. They also ushered in a new kind of war—a Cold War. The U.S. and Soviet Union, recent allies, now waged a technological war for weapons development and political influence. In this new kind of war, it was difficult to tell who was a friend and who was an enemy. During World War II, the U.S. Office of War Information warned that "Loose lips sink ships." That attitude of secrecy and distrust carried over into the Cold War.

During World War II, military research and technology development projects like those at the Harvard Computation Laboratory investigated problems requiring a great deal of cross-disciplinary collaboration[10] and cross-organizational communication. However, there were many obstacles to sharing information, such as the need for military secrecy and hesitance to share information that businesses or universities hoped would give them a competitive edge. "Lack of organized lines of communication exacerbated the difficulties encountered by those who were developing high-speed calculating devices in the 1940s and early 1950s. . . . The different centers of research worked in isolation to develop these fundamentals, often repeating mistakes, needlessly duplicating successful experiments, or entirely missing possible avenues

position of non-intervention. After the Germans invaded the Soviet Union in 1941, it changed this position to join the Allied forces. The Comintern was dissolved in May 1943.

9. United States Holocaust Memorial Museum, no date.

10. See Shell-Gellasch, A., 2002.

of research."[11] Computer developers took the situation into their own hands, holding conferences for sharing information at MIT, the University of Pennsylvania, and Columbia.

The conference at MIT was held in late October 1945, with 84 participants that included Lieutenant Commander Berkeley from the Harvard Computation Lab and Mina Rees, technical aide to Applied Mathematics Panel chief Warren Weaver. At the conference, Vannevar Bush and Samuel Caldwell introduced the new model of their differential analyzer housed at MIT. Howard Aiken discussed Harvard's calculating machines based on telephone relay technology and IBM component parts. John Brainerd and Presper Eckert presented their latest thinking about electronic high-speed computing devices, such as the ENIAC they were developing at the University of Pennsylvania. Participants shared the latest technology innovations for all these machine designs and discussed new applications for them. Conference discussions were prefaced by remarks from F. J. Maginniss representing General Electric, whose topic was "Some Industrial Applications of Machine Computing Methods." This concern with technology transfer from military to business applications was evidently a high priority for computer developers and an overarching issue for the conference. R.C. Archibald reported that the conference was "most notably successful and one heard on every side expressions of hope that such a Conference might be an annual event."[12] Unfortunately, isolated and secretive working conditions returned after the conference and some people working in the new field of computer development found this ongoing situation to be too frustrating and counter-productive.

Public-Private Partnerships

When Berkeley returned to civilian work at Prudential Insurance in August 1946, a new Methods Research Section had just been created to study "electronic calculators and punched card machines."[13] This effort was overseen by Prudential's Second Vice President Harry Volk, who had risen through Prudential's ranks, largely because of his work on the company's conversion to IBM punched card machines in the 1930s. During this conversion, Volk earned the reputation for being an "outstanding systems man."[14] In 1944, when the U.S. War Department asked Prudential President Franklin D'Olier to collect and analyze data on Allied bombing campaigns, he chose Volk to head the

11. Aspray, W., 1948/1985.
12. Archibald, R. C., 1945, 65.
13. Olmstead, B. E. no date.
14. Carr, W. H. A., 1975, 107.

company's punched card operation, the largest outside the U.S. government.[15] Volk had a staff of hundreds drawn from nearly every department at Prudential's home office, as well as 12 teams of writers and statisticians in Europe. Prudential was heavily invested in punched card technology, but was willing to explore the possibility that the new electronic computers could be integrated into their operations after the war.

Volk arranged to have Berkeley transferred from the Actuarial Department to the Methods Research Section to study potential applications of electronic calculators to Prudential's operations. By October, Berkeley had met twice with Volk to discuss expanding his assignment. He prepared a report to Volk and Charles Laing (head of the Operations and Methods Division) outlining his vision for applying scientific research and technological developments to Prudential's operations. Berkeley saw two important technologies that had immediate potential for the company: RCA's facsimile duplicator and Stibitz's computer at Bell Labs. He also listed seven recent inventions and possibilities:

- rapid, efficient storage of information on magnetic tape;
- the sound-powered telephone, which is energized by the power of the voice and can transmit messages over distances up to several hundred feet;
- electronic devices by means of which very small physical changes may be used to make very large physical changes;
- electronic devices by means of which very long sequences of operations may be performed in very short intervals of time;
- electronic digital calculators which perform 5000 additions a second and 500 multiplications a second;
- modern psychiatric knowledge by means of which attitudes and prejudices may be effectively handled; and
- fusion of mathematics, logic, semantics, syntax, grammar, and vocabulary, to make new languages for efficient explanation, easy access to knowledge, and accurate analysis.[16]

Berkeley believed that electronic devices employing symbolic logic could address problems in human affairs, such as "attitudes and prejudices." He also trusted in the benefits of psychiatry to help people resolve interpersonal problems and had visited

15. Ibid.

16. Berkeley, E., October 10, 1946.

a psychiatrist himself as early as 1939.[17] For example, in a note to himself dated January of that year, Berkeley rehearsed a suggestion to his Prudential supervisor Mr. Blagden that they visit a psychiatrist together to address their "impasse" concerning Berkeley's work performance. Berkeley's note specified either Dr. William Dunn[18] or Dr. Leo Stone[19] as psychiatrists who could help resolve his work conflict: "This is an opportunity for practical concrete behavior, establishment of new patterns, a real laboratory, instead of solely theorizing."[20] For Berkeley, the combination of electronic devices, symbolic logic, and psychiatric questioning promised to help people overcome prejudices and interpersonal conflicts.

In addition to the seven "inventions and possibilities," Berkeley set out eight problems at Prudential that he thought could profit from these new devices and ideas: "making information accessible; performing chains of routine operations in proper sequence; thinking and reasoning; turning sounds directly into writing, and writing directly into sounds; handling people well; explaining; transferring information; simplifying and mechanizing work."[21] In order to profitably apply these new technologies within Prudential, Berkeley argued that steps be taken without delay to strengthen communication channels. He suggested that he stay in touch with "engineering and scientific staffs of corporations and universities engaged in new developments," as well as related publications. Within Prudential, he wanted to know about "work performed in various parts of the Company." He proposed writing reports to "explain and to summarize what has been learned."[22] Berkeley then argued that this liaison work be assigned to him full-time and that an assistant and secretary be assigned to him. He foresaw that his team would be a "scientific research subsection of the Methods Division, Research."[23] Berkeley wanted to establish an electronics research laboratory at Prudential to study applications of digital computers and other new technologies to

17. Anonymous, January 14, 1939.

18. Quinter, J. 1988: "William H. Dunn, M.D. received his . . . M.D. from Harvard Medical School in 1927. . . . He served as . . . Associate Attending Psychiatrist at New York Hospital. Dunn also served as Chief of the Outpatient Department of the Payne Whitney Clinic and also taught at Cornell University Medical College. Dunn was a consultant at the post-World War II crime trials at Nuremberg, Germany."

19. Anonymous, August 3, 1997: Dr. Stone "guided his colleagues toward a more humanistic approach toward their patients. . . . Such views were considered radical. . . . [Dr. Stone] held neurology or psychiatry positions at several New York hospitals."

20. Berkeley, E., January 16, 1939.

21. Ibid.

22. Ibid.

23. Ibid.

insurance industry applications. He envisioned himself as the head of this lab, having a great deal of autonomy to decide what avenues of research should be pursued.

As Berkeley envisioned the expansion of his own authority at Prudential, Harry Volk had risen to the position of Second Vice President and was named to a five-person committee investigating the feasibility of opening a Western home office in California. In March 1947, a building site in Los Angeles had been chosen and Volk was named to head this first regional office. While the Prudential Building was under construction in Los Angeles, however, Volk was busy in Newark separating policy records that would be moved to the new Western region from the rest of the company's records. At the beginning of 1948 Volk reported that 625 people were engaged in work that would be separated from Newark operations and transferred to the Western Home Office in Los Angeles. To accomplish this separation, more than 2,000,000 punched cards had to be "reproduced, sorted in various classifications, and listed."[24] The challenge of opening the Western home office resulted in new approaches to data handling and information processing within Prudential, but these new approaches continued to rely on punched card technology. Unfortunately for Berkeley, Volk was becoming distracted by the opportunity to head Prudential's new Western office. His attention was turning away from the Organization and Methods Division and exploring possibilities for integrating new electronic data processing devices into company operations. Even so, Berkeley met with Volk and came away confident that he had Volk's support to establish a research lab.

On November 18, 1946, Berkeley submitted a follow-up report to Charles Laing, head of the Operations and Methods Division, giving additional details about the practical requirements for the proposed research lab and his own qualifications to head it. In this memo, Berkeley argued, "Scientific research and modern technology have become undeniably important." At Prudential, he followed, "any avenue of research which affects (1) handling of information, (2) routine, (3) clerks, can be important. For example, electronic tubes can handle information in millionths of a second; therefore here is an avenue of research of great potential value."[25] Berkeley further argued for the importance of research aimed at developing new operations to solve company problems:

> An example of a recent advance of knowledge . . . is new symbolic calculating techniques. One technique of this kind is symbolic logic. . . . An application of this technique was made by me in 1934 to the summarizing of beneficiary clauses, and has been in practical use in the Company from then to the present . . .

24. Carr, W. H. A., 1975, 134–135 .

25. Berkeley, E., November 18, 1946a.

> A second technique of this kind is computing machinery with control over the sequence of operations. This essentially is a science which through use of mechanized symbols seeks to solve problems of both reasoning and computing by machine. The models of these calculators now operating in New York, Philadelphia and Boston, save 6 to 8 times their cost and besides do problems that were previously impossible.[26]

Berkeley concluded that five factors were necessary for the proposed research lab to develop favorable results for the company: time and financial support; breadth of knowledge from different fields and from within company operations; imagination; perseverance; and interdepartmental cooperation. If Prudential would provide financial support and cooperation, Berkeley agreed to provide knowledge, imagination, and perseverance.

On the same day in November Berkeley wrote to Warren Weaver, then the director for natural sciences at the Rockefeller Foundation,[27] requesting support to design a machine that could "answer efficiently almost all the important and interesting questions of mathematics, logic, and reasoning." He argued, "In symbolic logic, it seems we have crossed the threshold of a new world in human thought—a stage where all the language of thought will be calculable like mathematics." Automated reasoning in the future, he argued, would be carried out by "animated symbols in machines."[28] Berkeley had been arguing for this type of "precision reasoning" since his 1930 Harvard University commencement address, "Modern Methods of Thinking," in which he cited Boole's "new system of symbolism for certain processes of reasoning which we are unconsciously performing over and over and over." He believed that Boole's "symbolism" had been "perfected" into "an amazing method of reasoning" based on "foundations of mathematics, philosophy, and the methods of thinking."[29] Berkeley argued that this scientific system of precision reasoning was necessary for addressing complex modern issues "and in disentangling our own thinking from prejudices."[30] With the advent of electronic computers, Berkeley clearly saw exciting possibilities for using these machines to carry out decision-making processes based on symbolic logic and deductive heuristics. He had been applying these heuristics himself to problems within Prudential's operations and during the 1930s had come up with an index for

26. Ibid.

27. Rees, M. no date.

28. Edmund Berkeley, November 18, 1946b.

29. Berkeley, E., 1930.

30. Ibid.

identifying settlement option clauses that the company still used in 1946.[31] Since his heuristics were based on true/false states, they could be translated from human language to machine language for solution, then back to human language so people could understand the results. By combining symbolic logic, binary numbers, and electronic equipment, humans could build machines that would emulate intelligent thinking processes.

By early 1947 Berkeley had established an electronics lab at Prudential, with a staff of Zehman Mosesson (an actuarial student with a Ph.D. in mathematics) and Henry Schrimpf (an experienced radio and electronics technician who Howard Aiken once described as a "mechanical genius"[32]). This group was charged with investigating computer developments that might prove useful at Prudential. "Berkeley was given a free rein to visit those people and companies who were engaged in any sort of computer related activity."[33] He believed that having an extensive knowledge of computer people and projects was an important key to his lab's success, so Berkeley made a point of getting to know what was going on in other companies' computer labs and who was working in them.

Conferences were important avenues for people in the young electronics field to learn about new technological developments and the people who were making them. By the end of 1946 two computer conferences had been held, at Massachusetts Institute of Technology and at the Moore School of Electrical Engineering in Philadelphia. The third major conference was held at the Harvard Computation Laboratory in January 1947 and Berkeley wrote a 28-page report for Prudential executives summarizing all conference sessions.[34] Computer historian William Aspray characterized the significance of this third conference: "Each of the major U.S. centers where computers were built in the 1940s had speakers on the program."[35] A number of computer luminaries attended the conference, including Howard Aiken, Wallace Eckert, Robert Everett, Jay Forrester, Herman Goldstine, Richard Hamming, Grace Hopper, John Mauchly, George Stibitz, Alan Turing, and Norbert Wiener.[36] The only manufacturer of electronic calculators represented on the symposium's program was Eckert and

31. Olmstead, B. E., no date.

32. Ibid.

33. Ibid.

34. Edmund Berkeley, November 18, 1946c.

35. Aspray, W., (1948/1985).

36. Ibid. Norbert Wiener withdrew from the speakers list at the last moment in protest of the military sponsorship of the symposium. In his November 18 report to Volk et al. (note above), Berkeley stated that Wiener "was to speak on 'The Problem of Gestalt.' At the last moment he sent a telegram

Mauchly's Electronic Control Company. As Aspray described the situation, "This lack of representation was probably not because of reluctance to divulge proprietary information but because there was yet little commercial activity in computers."[37]

The conference drew over 300 people interested in computers at a time when the entire field might have numbered less than 1000 people.[38] Berkeley had the opportunity to investigate the latest developments in both theory and machinery, including magnetic storage devices. He brought this information back to Prudential and immediately began to explore possible avenues for his electronics research lab. A month after the conference, MIT's Samuel Caldwell visited Prudential to explore closer cooperation between their two organizations.[39] Caldwell had spoken at the Harvard symposium and advocated establishing open lines of communication within the computer industry to facilitate more efficient development of theories, technologies, and training.[40] Berkeley recommended to Volk that Prudential begin the process of opening communications by working more closely with MIT. At the time Caldwell visited Prudential, he was also a member of the newly created Committee on High-Speed Computing Devices under the National Research Council. Membership on this committee included John von Neumann, Howard Aiken, Walter Bartkey, John Curtiss, George Stibitz, and Warren Weaver.[41]

Prudential Explores Electronic Computers

As early as November 1946, Berkeley worked with Prudential executives to develop specifications for an electronic calculator for that company's operations. But Berkeley believed that computer developments should be shared—both in theory and in the devices that were being developed. At this time, there were only a few electronic computers in existence, largely because they were expensive to build and the technology was not yet standardized. In addition, company executives did not readily see how electronic computers would make their operations more profitable because these ma-

declining to participate. The ground he stated to the newspapers was that science was here being used towards destructive military purpose."

37. Ibid. Although IBM was manufacturing computers at this time, the rift between Aiken and Thomas Watson at IBM, initiated at the dedication of the Mark I in 1944, continued to exert its influence. No IBM speakers were on the symposium's program, but nine scientists and engineers from IBM attended the event. (See Berkeley, E., November 18, 1946c in note above.)

38. Ibid.

39. Berkeley, E., February 6, 1947.

40. Caldwell, S. H., 1948/1985.

41. Grier, D. A., 2001.

chines were limited in the types of functions they could perform. So for any individual company, the benefits of purchasing a computer did not clearly outweigh the costs.

In February 1947, Berkeley explored the possibility of working with the National Bureau of Standards (NBS) to develop "Electronic Sequence Controlled Calculators for the Life Insurance Business."[42] Working with this government agency, insurance companies could pool their expertise and share the cost of using a computer that would be built specifically for insurance industry data processing. In this way, companies could cooperatively buy, build, and share time on one computer owned jointly with the government agency. The NBS already oversaw two contracts for electronic calculators, one for the Bureau of Census and one for the Navy. In a memo to Volk and other Prudential executives, Berkeley reported on his visit with Edward Condon[43] and John Curtiss at the NBS and set out a plan to secure NBS funding through an association of insurance companies. The funding would be used to manufacture three electronic calculators for the insurance industry, which would be shared by companies participating in the cooperative association. Berkeley explained that the NBS had a fund of $300,000 to help businesses develop "new machinery to handle information very rapidly. They want to see this field developed for the benefit of the public."[44]

Under Berkeley's plan, the three machines would be installed as trials in three companies; these companies would contribute a portion of their cost savings to the association to keep the project going. Patents would be held by the NBS, in a "nonexclusive, royalty-free, assignable license to all inventions which were for the

42. Berkeley, E., February 22, 1947.

43. Edward U. Condon became director of the National Bureau of Standards in 1945. As early as 1947, he was attacked for having Communist sympathies by Representative J. Parnell Thomas, chair of the Congressional Committee on Un-American Activities. In March 1948, the House Un-American Activities Committee (HUAC) issued a report labeling Condon "'one of the weakest links in our atomic security.' The case immediately became national news and a pressing cause for concern among American scientists. Condon was one of the first scientists in the postwar years to come under fire as a security risk, and his ordeal signaled the beginning of a time of difficulty for many scientists" (Wang, J. (1992, 238). Thomas based his attacks on Condon's membership on the board of the American-Soviet Science Society and membership in the National Council of American-Soviet Friendship. In April 1948 through his attorneys, Condon requested that he be able to cross-examine witnesses at a HUAC hearing scheduled for April 21. Their letter stated, "The effect of the publication of your accusations against Dr. Condon, and of the inflammatory and reckless manner in which that was done, may be devastating to the national interest . . . it has impaired the security and peace of mind of practically all of the leading scientists who are now employed on atomic bomb, radar, and related projects of fundamental importance to our security" (Anonymous, April 10, 1948). See also United States Congress, 1952/2011.

44. Berkeley, E., February 22, 1947.

first time reduced to practice as a result of the work under the contract. Such a provision . . . has the effect of keeping for public benefit the inventions which result from public funds."[45] His plan for collaborative technology development within the insurance industry, with support from the NBS, reflected his belief that technology developers had important social responsibilities because they benefitted from public funding and infrastructure. Berkeley believed that computers should be developed for the public good, not for private profits.

At this stage of computer development, a number of federal entities were involved in the transfer of military projects to postwar, civilian applications: the Department of the Navy, the National Bureau of Standards (NBS), and the Office of Scientific Research and Development. It was not yet clear who would benefit from the machines, programming, and processes that were developed—largely with wartime, public funding—in universities around the country. Commercial computer businesses were in their infancy, as were ideas about how to integrate computers into operations at established companies. As director of the Methods Research Section at Prudential, Berkeley worked with John Curtiss at the NBS and Mina Rees at the Office of Naval Research to establish a central mathematics and computing laboratory at the NBS. This NBS lab would serve as a resource for government agencies, private businesses, and universities needing the support of expensive large-scale electronic computers. This center, which was established as the National Applied Mathematics Lab in July 1947,[46] would also take the lead in developing computer equipment for public benefit. Berkeley saw his role in this effort as representing the insurance industry, since these private companies were likely to be early adopters of electronic computers' powerful data processing capabilities.

Berkeley, Curtiss, Rees, and others sought to establish this national mathematics lab in the midst of larger philosophical debates about postwar science and technology policy—the outcome of which would significantly impact their efforts. These debates centered around competing models of science support put forward by populist Senator Harley Kilgore and the business-minded director of the wartime Office of Science and Research Development (OSRD) Vannevar Bush. Both sides agreed that postwar federal support for basic scientific research and technology development would extend wartime military successes into peacetime civilian life, resulting in an improved

45. Ibid.

46. See Curtiss, J. H., 1989 for a history of the first five years of operation at the National Applied Mathematics Laboratories at the National Bureau of Standards.

standard of living and strengthened national security for U.S. citizens. How to structure that support was open for debate and the philosophical differences between advocates of these two perspectives posed significant challenges to finding a compromise solution, especially in the U.S. Congress.

Berkeley continued to work on a plan to install an electronic computer at Prudential, unsure whether it would be a shared machine or solely owned by Prudential. By the end of March 1947, Berkeley had distributed his specifications for Prudential's electronic calculator and had received bids for researching and/or building such a machine from the Moore School, Raytheon, and Engineering Research Associates. Berkeley also looked into using the Mark I calculator at Harvard or the Bell Labs machine on a time-sharing basis. In June 1947, Schrimpf and Mosesson from Berkeley's staff ran a test deck of premium billing punched cards on the Mark I and determined that this machine would operate "200 times faster and achieve production rates of 10,000 premium bills an hour."[47] Berkeley, however, believed that "moving information from one machine to another by means of punch cards requires human beings, and very often they create a bottleneck." Instead, he favored electronic machines, which were able to "transfer information from one part of a problem to another part of the calculation within the machine itself." He saw the future with "very great advances in methods not dependent upon the intervention of a human being."[48] Berkeley was skeptical of the long-term utility of a machine based on IBM punched card technology, such as Harvard's Mark I.

During his investigations in early 1947, Berkeley visited Presper Eckert and John Mauchly's Computer Corporation (EMCC) in Philadelphia and "became convinced that they were capable of developing a computer that could be used for premium billing and accounting."[49] Eckert and Mauchly had left the Moore School at the University of Pennsylvania over intellectual property differences and established their own company in Philadelphia in 1946. They were convinced that they could develop computing equipment for commercial use.[50] Berkeley arranged for Eckert and Mauchly to meet with Prudential Vice President Bruce Gerhard and Second Vice President Charles Laing (who had replaced Harry Volk).

47. Olmstead, B. E., no date.

48. Berkeley E., 1948/1985.

49. Olmstead, B. E., no date.

50. Norberg, A. L., 2005, 9.

EMCC was already in persistent and serious financial trouble.[51] They were negotiating to manufacture computers for the NBS and the Bureau of Census, but even when they won a $300,000 contract to produce a UNIVAC computer, EMCC lost money on the project. Unfortunately, Eckert and Mauchly had to develop most of the technology for this computer and their cost ran closer to $1 million before they could deliver the UNIVAC in 1951.[52] In an attempt to recoup some of their losses, they feverishly sought additional contracts with A.C. Neilson Company, Northrup Aircraft, Fairchild Aircraft, the Army Security Agency, and the Social Security Agency. They landed the Northrup contract, but again the specifications for the small BINAC computer they contracted to build resulted in extensive technology development, missed deadlines, and large financial losses.[53] It was during these difficult times in their young company that Eckert and Mauchly began negotiations with Berkeley to build a UNIVAC for Prudential.

Despite disappointing performance on EMCC's existing projects, Berkeley continued to advocate for Eckert and Mauchly with Prudential executives. On May 24 he wrote a memo recommending that Prudential sign a contract with EMCC to manufacture and install electronic information machinery. He based this recommendation on Eckert and Mauchly's experience and argued that their existing contracts showed the company to be "well on the road to permanence as an organization."[54] By June 1947, Berkeley was working with EMCC to draft a contract with Prudential. Yet Prudential

51. Eckert and Mauchly's company received contracts from the Army, Navy, and Air Force, but lost those contracts then John Mauchly was accused of Communist sympathies and activities. Arthur Norberg (2005) explained the situation this way: "[T]here was a security matter raised by the navy, which had been examining the possibility of contracting for a UNIVAC. On the basis of a classified report, the navy unit in question rejected the idea of a contract with EMCC. Nancy Stern, using information obtained in an interview with Mauchly, attributed this matter to attendance at a prewar meeting by Mauchly of an organization that had a Communist affiliation, unknown to Mauchly. Several members of the EMCC staff were accused of 'Communist leanings or alleged associations with Communists"' (172).

See also Stern, N., 1980, interview comments from Presper Eckert: "[T]he reason that we lost that [navy] contract was that they found several people working for us who failed security clearance. . . . A secretary for John was sleeping with a guy who was a Communist. As a matter of fact, he would take her to Communist meetings. Because of all this yelling and whooping they were doing under McCarthy about Communism—looking under every bed—they picked up on this. Therefore they decided maybe she's a Communist, and maybe John's a Communist. And then they found that one of our other guys was going to a Communist meeting—in fact two of our guys. . . . Neither of them were really Communists. They did go to a meeting and listened. And in those days, doing that was supposed to get you in trouble. . . . They cut our clearance which meant we couldn't get the $2 million contract, and they wouldn't tell us" (122).

52. Campbell-Kelly, M., & Aspray, W., 1996.

53. Norberg, A. L., 2005, 89.

executives were wary of this nearly bankrupt company and its growing record of nonperformance. On July 28, 1947, Berkeley submitted a memo to Gerhard, Laing, and other Prudential executives that surveyed existing suppliers of electronic machinery. It began by acknowledging the executives' doubts: "The question may well be asked why we selected Electronic Control Company. This memorandum is devoted to a brief discussion of the various possible suppliers, and the answer to this question."[55] Berkeley then surveyed fifteen suppliers and came to the conclusion that EMCC was the best choice. He reviewed shortcomings with such suppliers as Barber-Colman, Bell Labs, Center of Analysis at MIT, Engineering Research Associates, General Electric, Harvard Computation Lab, IBM, Moore School, RCA, and Raytheon. He also mentioned that the

> Bureau of Standards is much interested in promoting and aiding the developing of sequence controlled calculating machinery. It is acting as agent for the Navy and the Bureau of Census in contracting for two calculators. One contract for design and for demonstration of components is with [EMCC] for the Bureau of Census machine, and the other is with Raytheon for the Navy machine. Furthermore, they have some funds which are available on a public basis for the promotion of research and construction in this field.[56]

Here Berkeley again argued for NBS involvement with the Prudential project on the basis of its utility for the insurance industry. The memo was persuasive and Prudential executives agreed that EMCC was the logical choice for a limited contract. Instead of the full $300,000[57] that the machine would cost, they agreed to a contract in which Prudential would pay up to $30,000 to EMCC to "demonstrate key components and parts of a 'modern all-purpose electronic calculator."'[58] The Prudential executives wanted to be sure that Eckert and Mauchly could deliver on their promises.

Technology Development, Communication, and Public Policy

While Prudential Insurance negotiated with Eckert and Mauchly about building an electronic computer for the insurance industry, the U.S. Congress had lengthy debates about the best way to integrate this wartime technology into civilian life. An

54. Berkeley, E., May 24, 1947.
55. Berkeley, E., July 28, 1947.
56. Ibid.
57. $300,000 in 1947 would be equivalent to over $3.2 million in 2015.
58. Olmstead, B. E., no date.

especially thorny issue was the populist notion, put forward by Senator Harley Kilgore (Democrat, West Virginia), that computer innovation belonged to the public. On the other side of the question, Vannevar Bush (the business-minded director of the wartime Office of Science and Research Development), argued that private ownership of intellectual property was the best way to ensure that postwar technology transfer resulted in higher standards of living and strengthened national defense. The outcome of these policy debates had far-reaching implications for the structure of the post-war computer industry, its positioning between the "open communication" tradition of science vs. the "security clearance" tradition of the military or the "trade secret" tradition of business. Berkeley argued in favor of an open, populist approach for integrating computer technologies into general business operations and everyday life.

Policymakers after World War II recognized the importance of applied mathematics to peacetime prosperity and national security.[59] And unlike that earlier postwar period, policymakers after World War II were willing to directly support applied mathematics with federal structures and resources. Secretary of the Navy James Forrestal advocated that technology development would be just as valuable in peacetime: "In peace, even more than in war, scientists owe their nation an obligation to contribute to its security by carrying out research in military fields. The problem . . . is how to establish channels through which scientists can discharge this obligation in peace as successfully as they have during war."[60] In a 1945 report to President Roosevelt, Secretary Forrestal emphasized the need to develop channels through which scientific collaborations could continue. Two important characteristics of these channels would be their ability to facilitate open communication and their ability to support scientific work with the large-scale calculating machinery that would lead to rapid solutions for cross-disciplinary scientific problems.

> As early as 1942, Senator Kilgore and liberal New Deal supporters proposed that a federal agency be established to oversee scientific research and technology development, to share information, and to protect the interests of private entrepreneurs and inventors. In his model, an oversight board would include representatives of labor, small business, and public universities, as well as scientists, industrialists, and representatives of private universities. Kilgore's National Science Foundation would be accountable to the President and thus would operate within a system of political oversight, in the tradition of federal support for agricultural research. Vannevar Bush and the OSRD technocrats, however, believed that "[b]est science . . . had to

59. Grier, D. A., 2001 and Rees, M., 1980.

60. Rees, M. 1987, 833. See also Shell-Gellasch, A., 2002.

> be elitist in the sense of supporting the most excellent scientists,"[61] not populist in the sense of ensuring open access to federal support. Bush's proposal advocated that a Science Research Foundation be established by Congressional mandate, with administration from a part-time board of scientists but without oversight from the Office of the President. The proposed structure resulting from this model would resemble a business: productive organizations would have access to most of the federal resources and would be able to govern themselves efficiently without public or political oversight. This was the model that Warren Weaver had successfully implemented at the Rockefeller Foundation since the mid-1930s, where he personally chose grant recipients without peer review.[62]

These Congressional debates about science policy dragged on through 1946; technology developers were caught in the tension as they sought to develop new computer devices and integrate them into civilian, industrial operations. Day-to-day necessities dictated that someone had to oversee technology development and transfer, so this function was effectively assumed by federal agencies: the Office of Naval Research, the National Bureau of Standards, the Atomic Energy Commission, and the newly formed Department of Defense. Computer developers worked with these federal agencies, but also sought to develop their own communication structures to support knowledge sharing among people who might unknowingly be working on related projects. Mina Rees recalled that "there was a relatively small group that played a central role" in computer development.[63] Even with their small numbers, computer developers found it difficult to stay abreast of the advances in their rapidly changing field.

One of the first opportunities for computer people to gather and share information took place at Dartmouth in 1940 when George Stibitz demonstrated how the Bell Labs Complex Number Calculator was used for telecommunications. The MIT conference in late 1945 was another early example of computer people getting together to share information and ideas. After this successful conference, however, computer developers continued to work largely in isolation, except for leaders in the field, like Aiken, Von Neumann, and others who operated within networks of shared information. For those outside these networks, like Edmund Berkeley and most other people, sharing information continued to be difficult.

61. Mazuzan, G. T., 1994.

62. Rees, M., 1983 and Reingold, N., 1999.

63. Rees, M. 1987, 846.

Opening a Professional Association for Computer People

In January 1947, the Symposium on Large-Scale Calculating Machinery was held at Harvard University, co-sponsored by the Department of the Navy. "In addition to the extensive group of technical papers, the program included a demonstration of the . . . Mark I Calculator . . . and a preview of the Mark II Calculator . . . being assembled at Harvard for the Bureau of Ordnance . . . at the Dahlgren Proving Ground."[64] The symposium was attended by over 300 people—about six times more than the organizers had originally anticipated. Berkeley attended sessions, and recorded notes which he later compiled into a report for Prudential executives. He also took part in discussions following paper presentations, for example, questioning Lewis Tabor and L.S. Dederick from Moore School about the percentage of operating time vs. down time for the ENIAC[65] and comparing the attributes of sequential programming using punched cards with Presper Eckert and Theodore Sterne after George Stibitz's presentation.[66] He also discussed the possibilities of magnetic drum storage devices with Alan Turing, John Curtiss, Morris Rubinoff, and Benjamin Moore after Moore's paper reporting on research at the Harvard Computation Lab.[67]

This symposium was especially important to the non-elite computer people because they could share ideas and join in discussions about computer development across organizational lines. Aiken's opening address to the symposium emphasized the importance of sharing information among computer developers:

> A great variety of new techniques has been introduced into the design of calculating machinery. . . . There has been inadequate publications of results, and inadequate transmittal of results from one group working in the field to another. Consequently, we have often found that we were working on problems that had already been solved by others. We have found that we were beginning researches that were nearing completion in other laboratories. Those are precisely the reasons why this symposium seems so necessary at this time.[68]

The international importance of a robust communication system around computer development was underscored at the symposium by Rear Admiral Joy, whose introduction of Aiken included these remarks: "[M]ilitary and peacetime uses [of mathematics] are interlinked. . . . Perhaps it is not beyond the realm of fantasy to predict that future

64. Curtiss, J. H. 1947, 229.

65. Tabor, L. P., 1948/1985.

66. Stibitz, G. R., 1948/1985.

67. Moore, R. L. 1948/1985.

68. Aiken, H. H. 1948/1985, 7.

developments in the art of building mechanical brains may produce one capable of contributing to the analysis of the problems of international relationships."[69] Mina Rees, who chaired the Mathematical Methods session at the symposium, summed up the situation in 1947 this way: "Around the county there was clear evidence of an increasing desire to stay in touch with the rapidly changing technological scene and to establish improved means of communication among the many persons who were professionally interested in the new machines."[70] In the minds of mathematicians involved with post-war computer development, establishing a communication to "stay in touch" had important national security and quality-of-life implications. Conversely, if computer developers did not "stay in touch," the nation could face unnecessary risks from Cold War adversaries and our national security could be threatened.

In his closing address to the symposium, MIT's Samuel Caldwell restated the importance of establishing a communication system for computer developers and mathematicians. But he identified two impediments to establishing an open information sharing system: private industry's patent concerns and the military's concerns for classifying information sensitive to national security.[71] Traditionally, communication about technology development was compartmentalized and controlled either within private companies or within divisions of military organizations. Yet as Howard Aiken had noted at the beginning of the symposium, such controlled communication practices resulted in inefficient technology development; researchers often unknowingly duplicated their efforts when they could not communicate across organizational barriers. Reporting on this "significant meeting," John Curtiss noted that the "extensive program reflected every phase of the sweeping progress being made in the field of large-scale calculators, and the large attendance offered a unique opportunity for the numerous small group meetings which do much to facilitate the exchange of helpful information."[72]

As a result of that symposium, computer developers recognized the rapid growth of the field and the significant problem that a lack of open, timely communication posed to their success. If they did not stay in touch, they feared that the U.S. could face infiltration from Cold War adversaries and their way of life would be vulnerable to Communist overthrow. In his closing address to the symposium, Caldwell called for establishing a professional association to support systematic communication among computer developers: "It is this communication system that I have described as consisting of

69. Joy, C. T., 1948/1985, 6.

70. Rees, M. 1987, 104.

71. Caldwell, S. H., 1948/1985.

72. Curtiss, J. H. 1947, 230.

two elements: an organization to make us more immediately and more continuously aware of a common purpose and thus furnish the incentive for communication; and a medium for such communication."[73] Mina Rees remembered that "when Sam Caldwell stood before the audience attending the Symposium on Large Scale Calculating Machinery at Harvard and called for the establishment of a new association to provide for better communication among those interested in the new machinery, it struck a responsive note."[74] Berkeley took action and developed a proposal for a new professional association.

In June 1947 Berkeley sent out a "Notice on Organization of an 'Eastern Association for Computing Machinery."' This notice stated that the new organization was intended "for those interested in the new machinery for computing and reasoning."[75] Preliminary plans called for meetings to be held in Boston, New York, and Philadelphia, with program subcommittees and secretaries in each of these three locations. Meetings would be held every few months, with papers being presented and discussed at each meeting. The first meeting was scheduled for September 1947 at Columbia University, where T. K. Sharpless would present a paper on "The Pilot Model of the EDVAC."[76] People who were interested in this new association sent their contact information and suggestions to Berkeley, care of the Methods Division at Prudential Insurance. As acting secretary of the Eastern Association for Computing Machinery, Berkeley recruited membership from people throughout the eastern U.S., from Maine to North Carolina.

Not everyone in the computer field was eager to start a new association, however. Berkeley recounted some of the reactions he received to his proposal: "John von Neumann said, 'Oh, for heaven's sake, not another association.' And George Stibitz said, 'Oh, not another association'. . . . But I remarked to several of the people there that if the prominent people would not have an association, the second-level people might very well have an association."'[77] The prominent computer people in 1947 already participated in organizations such as the American Institute of Electrical Engineers (AIEE), the British Institution of Electrical Engineers, the Institute of Radio Engineers (IRE), the American Mathematical Society, and the Mathematical Association of America. The proceedings of these organizations were reported in the National Research Council journal, which added a regular feature on "Automatic Computing Machinery"

73. Caldwell, S. H., 1948/1985, 282.

74. Rees, M., 1980, 611.

75. Berkeley, E., June 25, 1947.

76. Berkeley, E., August 21, 1947.

77. Berkeley, E., 1988.

to their October 1947 issue. That issue covered AIEE and IRE meetings in early 1947, detailing talks by John von Neumann, Howard Aiken, Julian Bigelow, Herman Goldstine, Jay Forrester, T. K. Sharpless, and John Mauchly. It also covered meetings of the Life Office Management Association, where Berkeley was appointed to a committee to study the use of "electronic sequence-controlled calculators" in life insurance operations, and the Actuarial Society of America, where Berkeley presented a paper on "Electronic Machinery for Handling Information, and its Uses in Insurance."[78] The prominent mathematicians already had their network of professional associations. But Berkeley felt that applied mathematicians and people working on the everyday tasks of computer machinery development did not have access to these networks. "And so we put together a meeting in September at Columbia University . . . something like 57 people attended, and one of the resolutions passed was to form an Eastern Association for Computing Machinery" (EACM).[79]

Mina Rees recounted that "Ed Berkeley and John Curtiss [from the National Bureau of Standards] were particularly active in urging the establishment of the new Association for Computing Machinery. John became its first president, and Ed, the first secretary."[80] Franz Alt later recounted, "During this early period and for some years thereafter, the burden of work for the association fell mainly upon the secretary, E. C. Berkeley."[81] Alt and Rees joined this initial group as members of the six-person Executive Council.

At their first meeting in September, 223 people representing 74 organizations had expressed interest in participating in the EACM. In its insistence on geographical representation and open access to information for the low dues of $1 per year, the initial EACM philosophy reflected a traditionally scientific model of open information sharing among professionals and amateurs alike. In a letter to Berkeley shortly after this first meeting, John von Neumann stated that he was "much interested in the work and development of your organization." But he was still skeptical that the time was right for establishing the EACM: "[S]uch an association is a highly desirable one ultimately but . . . the general situation has not yet matured sufficiently to make the present moment the optimum one to found it. This does not mean, however, that I will not be very glad if you succeed in furnishing the proof of the opposite."[82] Taking this as a sign of interest, Berkeley added von Neumann's name to the EACM mailing list.

78. Anonymous, 1947.

79. Berkeley, E., 1988.

80. Rees, M., 1987, 835.

81. Alt, F. 1962, 302.

82. Berkeley, E., September 30, 1947.

By December 1947, "Eastern" had been removed from the name and the ACM was the international organization that it has continued to be since then.[83] The purpose of the Association for Computing Machinery (ACM) was to "advance the science, design, construction, and application of the new machinery for computing, reasoning, and other handling of information. Anyone interested in this purpose may become a member."[84] Eric Weiss noted that "some early ACM leaders saw the society as a declaration of independence from IBM, and by extension, from all commercial considerations."[85] As an association governed by computer developers for the benefit of computer developers, the ACM's structure and mission reflected its ideology that computer technologies should be dedicated to the public welfare, not primarily to serving private business or the military.

Also in December 1947, the ACM held its first conference at the Aberdeen Proving Ground Ballistic Research Laboratories with over 300 people attending. Thirteen papers were presented, including topics covering the cutting-edge questions of that time:[86]

- "General Principles of Coding, with Application to the Eniac" (John von Neumann)
- "Adaptation of the Eniac to von Neumann's Coding Techniques" (R. F. Clippinger)
- "Optimum Size of Automatic Computers" (George Stibitz)
- "The Univac" (John Mauchly)
- "The Raytheon Computer" (R. V. D. Campbell)
- "Operating Characteristics of the Aberdeen Machine" (Franz Alt)
- "Reduction of Doppler Observations" (D. Hoffleit)
- "On the Approximate Solution of a Partial Differential Equation on the Differential Analyzer" (Joseph Levin)
- "Non-Linear Parabolic Equations" (Bruce Hicks)
- "Computation of the Airflow about a Cone Cylinder" (M. Lotkin)
- "Air Flow Problem Planned for the Eniac" (R. F. Clippinger)

83. Berkeley, E., 1988.

84. Berkeley, E., June 25, 1947.

85. Weiss, E. A., 2005.

86. Berkeley, E., January 30, 1948.

- "Laminary Boundary Flow in a Compressible Fluid" (John Holberton)
- "Census Applications of High Speed Computing Machines" (James McPherson)

ACM meeting reports and summaries of conference papers were distributed by Secretary Edmund Berkeley to association members through the mail and through a regular column in the National Research Council's quarterly. ACM publications were an important tool for achieving the association's mission and Berkeley took the lead in establishing these publications.

Berkeley painstakingly maintained a list of computer professionals, which he initially distributed in 1951 under the title "A Roster of Organizations in the Computing Machinery Field." Eric Weiss recalled how Berkeley would invariably ask for business cards from people he didn't know, so he could add their contact information to his rosters.[87] Berkeley also compiled a "Glossary of Computer Terms" with contributions from colleagues like Grace Hopper, which he made available to computer professionals to help standardize the language of computer development for sharing ideas. The wide distribution of information supported by the ACM represented a tangible solution to the communication problem facing computer developers at the end of World War II. Today, the work of identifying people in the computing field and establishing a common technical vocabulary for their work may seem trivial. In 1947, however, Berkeley's activities helped to provide a foundation for establishing computer science as a professional field in its own right, separate from electrical engineering and mathematics.

Future Catastrophe Hazards

While Berkeley was working to establish the ACM as the first professional association for computer people, he was also studying the possibility of integrating electronic computers into Prudential's operations, especially for premium billing. After looking at a number of machines, Berkeley recommended that Prudential buy an "electronic machine" from Eckert-Mauchly Computer Corporation (EMCC)[88] and Prudential agreed with some stipulations that EMCC meet a series of deadlines for delivering the Univac computer. Prudential executives were not completely convinced that Eckert and Mauchly's business was in good financial shape. In a January 1948 memo, Berkeley assured Prudential executives that EMCC's business prospects were sound, listing current and prospective orders from Fairchild Engine and Aircraft, Northrop

87. Weiss, E. A., February 19, 2011.

88. Eckert-Mauchly Computer Corporation was incorporated in December 1947, replacing the Electronic Computer Corporation name that group used previously.

Aircraft, Army Security Agency, A. C. Nielsen, Bureau of Standards/Office of Naval Research, Social Security Agency, India, and Sweden.[89] Prudential was set to order one of the first six computers manufactured at EMCC.[90] Questions persisted, though, concerning EMCC's financial stability, especially after a negative report from the National Bureau of Standards (NBS). As part of their investigation before purchasing one of EMCC's Univac machines, the NBS assigned a subcommittee to evaluate the company's prospects of successful delivery. The subcommittee—consisting of John von Neumann,[91] George Stibitz,[92] Howard Aiken,[93] and Samuel Caldwell[94]—wrote their negative report without visiting EMCC or seeing a demonstration of the machine. Their findings cast doubt on EMCC's financial health, their patent rights, and their ability to deliver a Univac on time and within budget. Berkeley met with John Mauchly on March 26 after a conference at the NBS and wrote a report to Prudential Vice-President F. Bruce Gerhard. In his report, Berkeley confirmed that the company was sound, that it had suffered "only a limited loss of rights to their discoveries and inventions," and that "their equipment will be excellent technically."[95] Prudential executives continued to question whether it would be more cost effective to continue with an updated IBM punched card data processing system rather than undertake another costly conversion to integrate electronic computers into their operations.

While these deliberations were going on at Prudential, Chief Research Consultant Berkeley was also concerned with risks posed by political tensions and the use of newly developed weapons. How could people avoid another war? To explore this question, Berkeley established a Group on Future Catastrophe Hazards to study possible "effects of weapons of mass destruction" for Prudential and insurance companies in general.

89. Berkeley, E., January 22, 1948.

90. Berkeley, E., March 21, 1948.

91. In 1948, John von Neumann was heading a team to build an electronic computer—based on "von Neumann architecture"—at the Institute for Advanced Study in Princeton, New Jersey.

92. By 1948, George Stibitz had designed five large calculating machines for Bell Telephone Laboratories based on telephone relay technology. These machines were purchased and used by the U.S. Army for ballistics calculations.

93. In 1948, Howard Aiken was heading a team to build the Mark III relay computer at Harvard University Computation Laboratory. Like the Mark II, this third-generation machine was purchased and used by the U.S. Naval Proving Ground at Dahlgren, Virginia.

94. In 1948, Samuel Caldwell led the Center for Analysis at Massachusetts Institute of Technology, which was developing an electronic computer funded by a Rockefeller Foundation grant. (See Caldwell, S., April 23, 1946.) The MIT Center for Analysis also supported Jay Forrester's team which was developing the Whirlwind I computer for the Office of Naval Research.

95. Berkeley, E., March 28, 1948.

Among the objectives of this group were studying and promoting "sensible attitudes," as well as encouraging "cooperation between societies and persons everywhere who are interested in preventing the use of weapons of mass destruction and keeping the peace." He also supported suggestions that "one percent of military funds be used by scientists for peace," that "committees on survival" be established within scientific societies, and using "life insurance company advertising to explain—without endorsing—the United Nations, World Federation, etc."[96] At the time Berkeley investigated these questions, it had been less than three years since the U.S. dropped the first atomic bomb on Hiroshima. The Soviet Union had extended its influence throughout Central Europe, Eastern Europe, and China; they were on the verge of developing the next generation of atomic weapon—the hydrogen bomb—with long-range missiles to deliver it. The world had experienced two wars in less than 40 years; there was reason to believe that we would see World War III before the end of the 20th century. And there was reason to believe that the next war would be nuclear, with mass destruction possibly visited on the United States. The purpose of Berkeley's Group on Future Catastrophe Hazards was to calculate the risk of such destruction, and hopefully lower that risk through efforts to support peaceful cooperation among nations.

In the politically charged postwar years, Prudential Vice-President F. Bruce Gerhard became uncomfortable with Berkeley's work with the Group on Future Catastrophe Hazards. He met with Berkeley and instructed him to "close the company aspect of this project." He had concluded that "this work was not of any value to the Company nor did it look as if it could be of any value."[97] Gerhard did not want Prudential to have any association with Berkeley's project and did not feel that Berkeley could continue the project himself without creating the impression that Prudential supported his work. Berkeley "could not agree to any such restriction on . . . [his] personal actions"[98] and offered his resignation effective July 22, 1948.[99] Before he left, Berkeley prepared a memo on the state of the Univac project and a proposed addendum to the EMCC contract, which were delivered to Prudential executives by Berkeley's Methods Research staff.[100]

Before Berkley's departure, EMCC had missed January deadlines for developing and demonstrating the Prudential Univac. "At that point, the Prudential could have insisted that half of their $20,000 be returned. They did not, and the contract dragged

96. Berkeley, E., March 18, 1948.

97. Gerhard, F. B., June 21, 1948.

98. Berkeley, E., June 5, 1948.

99. Berkeley, E., July 7, 1948.

100. 98 Schrimpf, H., July 16, 1948; Mosesson, Z. I. and Berkeley, E., July 23, 1948.

on."[101] EMCC struggled to meet their development deadlines, but reported to Prudential's board in 1949 that it would "be quite some time" before their Univac would be delivered.[102] EMCC's difficulties continued and in 1951 Prudential executives decided to cancel their contract. Their conversion to electronic operations was abandoned, as they contracted instead with IBM for new punched card machines.

101. Norberg, A. L., 2005, 168.

102. Carr, W. H. A., 1975, 196.

Robots and *Giant Brains*, 1942–1961

Following the author's reasoning we might look to these machines for a logical answer to the problem of private capitalism or laissez-faire versus Socialism or a planned economy.

—Henry C. Link[1]

Berkeley's efforts to organize the Association for Computing Machinery helped to make information about computers more openly available to computer people in businesses, government, and universities. But this was just a start. Berkeley had a bigger plan for ensuring that the public could participate in computer developments: he would write a book for the non-expert reader explaining how these powerful calculators worked. Berkeley felt that the average American should know about these machines, which he described as coming "closer to being a brain that thinks than any machine ever did before 1940."[2] Berkeley started this project in 1942, and by October 1946 he had a contract with John Wiley & Sons for the book *Giant Brains or Machines That Think*, "describing the newest calculating machinery."[3] For the first time, Berkeley's book would explain the workings of electronic computers—or mechanical brains—to people who were not "computer people." With this book, Berkeley could show the importance of symbolic logic through its applications to machine intelligence.

Because he was writing for people who were not familiar with computers, Berkeley applied the "scientific rhetoric"[4] of Rudolf Flesch, the "Apostle of 'Plain Talk,'"[5] who

1. Link, H. C., February 25, 1950, 26.

2. Berkeley, E., 1949, vii.

3. Berkeley, E., November 18, 1946a.

4. Longo, B., 2003.

5. Anonymous, April 12, 1947.

had recently developed an "ease of reading" formula. During World War II, Flesch worked at the Office of Price Administration (OPA), where he rewrote government documents into understandable English at a 6th grade level. By 1947, Flesch was the "undisputed high priest of a . . . cult of 'readability'"[6] as a result of his OPA work, plus a 1946 book he wrote on his readability methods, and adept publicity. Berkeley contacted him to discuss the idea of establishing a "readability laboratory" at Prudential Insurance where they could explore "the possibilities of symbolic logic for the systematic simplification of complex exposition," as well as "the drafting of an insurance policy that any policy-holder can understand."[7] Berkeley also sent Flesch draft chapters of *Giant Brains* in mid-1947 for his review. Flesch responded with two pages of recommendations, summed up in this comment: "I think you have concentrated 100% on the logic of the subject and neglected the psychology of the reader. What he needs is the whys and wherefores, the drama of the thing, the human element in the development of these machines."[8] Flesch found the topic of the book "fascinating," but worried that Berkeley would lose readers because "you can't understand the machines without understanding mathematics."[9] He suggested that Berkeley omit all references to symbolic logic and foreground the human "story" about "the men who worked on these giant brains and a picture of what it's like to watch them in operation."[10] As he continued writing *Giant Brains*, Berkeley emphasized the similarities between human and machine operations to help readers understand the book's unfamiliar information about "machines that think."

Comparing his experience as an actuary (or human computer) to artificial intelligence, Berkeley described a "mechanical brain" as being "a machine that handles information, transfers information automatically from one part of the machine to another, and has a flexible control over the sequence of its operations."[11] Because some of these mechanical brains could work out many types of problems accurately, rapidly, and without rest, "they can solve problems that a man's life is far too short to permit him to do."[12] These mechanical brains could carry out some human thinking tasks, but with "powers . . . like those of a giant. Therefore, Berkeley argued, "we may

6. Ibid, 22.

7. Flesch, R., May 29, 1947.

8. Flesch, R., June 27, 1947.

9. Ibid.

10. Ibid.

11. Berkeley, E., 1949, 5.

12. Ibid., 1

call them *giant brains*."[13] When the manuscript for *Giant Brains* was finished in 1946, Berkeley found that six of these giant mechanical brains existed, built between 1942 and 1946: the Differential Analyzer Number 2 at Massachusetts Institute of Technology, the Mark I at Harvard University, two computers at the Army's Aberdeen Ballistic Research Laboratories, the Bell Laboratories' General Purpose Relay Calculator, and the Eniac at the Moore School. Although other automatic calculating machines existed, Berkeley singled out these particular computers as representing the state of the art after World War II.

Berkeley began *Giant Brains* with a discussion of the similarities between computers and human brains, arguing that "mechanical brains" can do some kinds of "thinking" better than humans: learn what you tell them; apply the instructions when needed; read and remember numbers; add, subtract, multiply, divide, and round off; look up numbers in a table; look at a result, and make a choice; do long chains of these operations one after another; write out an answer; make sure the answer is right; know that one problem is finished, and turn to another; determine *most* of their own instructions; and work unattended.[14] Despite these thinking capabilities, Berkeley found there were still four kinds of thinking that machines could not perform: think intuitively; make bright guesses and leap to conclusions; determine *all* necessary instructions; and perceive and interpret complex situations outside itself.[15]

Claiming that clever animals such as foxes are also capable of these four thinking skills, Berkeley predicted that there was "good reason to believe that most, if not all, of these operations will in the future be performed not only by animals, but also by machines."[16] He further predicted that "machines will probably be made that will know what is in libraries and that will tell very swiftly where to find certain information. Thus we can see that mechanical brains are one of the great new tools for finding out what we do not know and applying what we do know."[17]

For the purposes of comparing human and machine thinking, Berkeley defined four important terms

- *Thinking* is "computing, reasoning, and other handling of information."
- *Information* is "collections of ideas—physically, collections of marks that have meaning."

13. Ibid., 1
14. 14 Ibid., 7
15. Ibid., 8
16. Ibid., 8.
17. Ibid., 9.

- *Handling* is "proceeding logically from some ideas to other ideas—physically, changing from some marks to other marks in ways that have meaning."
- *Languages* are "systems for handling information."[18]

Berkeley then argued that languages were both a "*scheme for expressing meanings* and *physical equipment* that can be handled." Using spoken English as an example, meanings are expressed through 150,000 words and rules for combining them, while sound waves and people's ears are the physical equipment. Mathematics using Arabic numerals is another example of a language, with ten digits and rules for combining them, using the physical equipment of a pencil and paper, or a mechanical desk calculator. Berkeley pointed out that it would not be possible for someone to exchange the physical equipment of spoken English and mathematics to express meanings.

The most important operations in handling information were storing it and combining it. Berkeley set out five characteristics of physical equipment for easy and efficient storing and combining of information: costs little; holds much information in little space; is *permanent*, when we want to keep the information; is *erasable*, when we want to remove information; and is *versatile*.[19] In setting out these characteristics, Berkeley laid a foundation for claiming that mechanical brains would be more efficient for handling information than human beings. To illustrate his point, Berkeley provided details for the simple design of his 4-cubic-foot Simon mechanical brain, which could handle information—or think. It used "*punched paper tape* for putting information in, *relays* . . . and wires for storing and transferring information, and *lights* for putting information out."[20] This machine used numbers 0, 1, 2, and 3 to carry out two operations: "greater than" and "selection."[21] Simon also had short-term memory to internally store numbers while making calculations.

Berkeley shared the plans for Simon, inviting readers to build their own small, personal computer and to contact him directly with their questions. He believed that even people who did not have access to large computing machines could learn about computers using Simon. He intended this small mechanical brain as a tool to train both "the few who must work with the big machines, and . . . the many who wish to understand them."[22]

After providing details for readers to build their own Simon computer, Berkeley spent the next six chapters covering the strengths and limitations of other computer

18. Ibid., 10.

19. Ibid., 15.

20. Ibid., 23.

21. Berkeley, E., 1950, 41.

22. Ibid., 40.

designs. He began with a chapter on punch-card machines, highlighting their operations in a life insurance company. He concluded that this type of machine was useful where a number of cases needed to be handled in a standardized manner, which was impossible with human computers using desk calculators. "As soon as the number of cases to be handled is more than a hundred and each item of information is to be used five or more times, punch cards are likely to be advantageous, provided other factors are favorable."[23]

He next examined the MIT Differential Analyzer analogue machine that was built to solve differential equations in which physical quantities are related to one another. After providing technical information about the design and use of the machine, he described how quickly the machine could find answers to problems:

> The time for setting up a problem to be run on the machine ranges from 5 to 15 minutes. The time for preparing the tapes that set up the problem is, of course, longer. . . . The time for the machine to produce a single solution to a problem ranges usually from 3 minutes to a half-hour. It is easy to put on a problem, run a few solutions, take the problem off, study the results, change a few numbers, and then put the problem back on again. This virtue is a great help in a search in a new field. While the study is going on, time is not wasted, for the machine can be busy running a different problem.[24]

Berkeley ended this chapter on the analogue machine by citing an experimental use of the machine by an insurance company in Great Britain, which adapted this design for computing insurance values for continuous annuities and continuous contingent insurances.[25]

Berkeley then turned to the relay design of the IBM Automatic Sequence Controlled Calculator (Mark I) at Harvard University, which "started work in April 1944 and has been running 24 hours a day almost all the time ever since."[26] After explaining this machine and its operation in great detail, Berkeley concluded that it was "a landmark in the development of machines that think. Its capacity for many problems for which it is suited is far beyond the capacity of a hundred human computers."[27] Although Berkeley gave credit to Howard Aiken and the "men of International Business Machines

23. Berkeley, E., 1949, 64.

24. Ibid., 87.

25. Ibid., 88.

26. Ibid., 89.

27. Ibid., 108.

Corporation who made this great mechanical brain come into existence,"[28] he concluded that this type of calculator would not be used in the future because electronic computing was "easily 100 times as fast as relay computing."[29]

Turning next to the Army's Electronic Numerical Integrator and Calculator, or Eniac, Berkeley described this machine in human terms: "[I]n February 1946 he began to earn his own living by electronic thinking. . . . He was the first giant brain to use electronic tubes for calculating."[30] After reviewing technical information for the design and operation of the machine, Berkeley found it to be a "novel" design with uneven operation. It calculated additions and subtractions at the rate of 5000 per second, multiplications at 360–500 per second, and divisions at 50 per second, which meant that problems needing division considerably slowed the machine. Instead of using punched paper tape programming like the Mark I at Harvard, the Eniac was programmed through an IBM punched card feed, which also slowed the machine's operation.

Although the Eniac could be used for many types of problems, it was initially built to calculate ballistic trajectories for Army missiles. When used for these trajectory calculations, new problems could be programmed without changing too many wires and switches on the room-sized machine's panels. But when different types of problems were run, programming was time-consuming: "You have to plug large numbers of program trunk lines and digit trunk lines, or you have to set large numbers of switches, or both. Also, when you wish to return to a previous problem, you must do all the plugging and switch setting over again. Many delays in the operation of the machine are due to human errors in setting the machine for a new problem."[31] Internal memory for this first electronic computer was 20 registers,[32] only large enough for short-term storage of numbers during calculations. There was no storage for programming, so programmers had to set Eniac's mechanical dials and switches for each unique problem. Despite its limitations, Berkeley concluded that "at the Ballistic Research Laboratories, for a typical week of actual work, Eniac has already proved to be equal to 500 human computers working 40 hours with desk calculating machines."[33]

28. Ibid., 112.

29. Ibid., 111.

30. 30 Ibid., 113.

31. Ibid., 125.

32. A storage register was one relay switch, which could indicate a 0 or 1 in binary notation. Berkeley's Simon computer had 4 registers. The Harvard Mark I had 72 storage registers. These registers functioned as memory devices only for short-term storage of numbers.

33. Berkeley, E., 1949, 127.

This need to streamline human computing operations was at the heart of Berkeley's discussion of the General Purpose Relay Calculators being built at Bell Laboratories. He described the situation at Bell Labs in which "girl computers"[34] were called upon to make extensive calculations with complex numbers as Bell designed new circuits for its long-distance telephony operations. Each computation required "6 multiplications, 2 additions, 1 subtraction, and 2 divisions of ordinary numbers—and always in the same pattern or sequence."[35] He then told the story of how George Stibitz designed a Complex Number Calculator using telephone relay switches and binary coding: "Six or eight panels of relays and wires were in one room. Two floors away, some of the girl computers sat in another room, where one of the teletypewriters of the machine was located. When they wished, they could type into the machine's teletypewriter the numbers to be multiplied or divided. In a few seconds back would come the answer."[36]

During World War II, this early Bell Labs computer was redesigned into a special-purpose machine for determining the accuracy of gun-aiming instruments for the Army. After the war, the U.S. government contracted with Bell Labs to design two special-purpose relay computers, which went into operation in 1946. These machines produced results that were almost 100% accurate for a variety of problems, leading Berkeley to find this design "probably the best mechanical brain made up to the end of 1947."[37] They were programmed using three kinds of punched paper tape for each problem: *problem tapes*, which contain information belonging to the particular problem; *table tapes*, which contain tables of numbers to be referred to from time to time; and *routine tapes*, which contain the program, or routine, or sequence of steps that the machine is to carry out.[38]

Berkeley described how human and machine computers worked together to make calculations with the General Purpose Relay Calculator. First a mathematician organized the

> scheme of the calculation. Then, a girl goes to one of the hand perforators. Sitting at the keyboard, she presses keys and punches out feet or yards of paper tape expressing the instructions and numbers for the calculation. . . . Another girl, using the other hand perforator, also punches out the instructions and numbers for the calculation. . . . a girl takes [both tapes] over to the processor and puts them both in. The processor has two tape feeds, and she puts one tape on each and starts the

34. Ibid., 129.
35. Ibid., 129.
36. Ibid., 130.
37. Ibid., 141.
38. Ibid., 134.

> machine. The processor compares them row by row, making sure that they agree, and punches a new tape row by row. . . . Next, the girl takes the punched tape made by the processor over to a problem position that is idle. . . . A problem position looks like a large covered-over table. Under the covers are 12 tape feeds, or *tape transmitters*. . . . Six-hole paper tape can be fed into any transmitter. Six metal fingers sense the holes in the paper tape and give out electrical impulses at proper times.[39]

Although this machine could run unattended, Berkeley reported that it was staffed by a mathematician/engineer, a maintenance worker, and "about six girls for punching tape, etc., depending on the number of problems to be handled at the rate of about one problem per week per girl."[40] Even with all these design improvements, Berkeley predicted, "It is unlikely that the general-purpose relay computer will be manufactured generally."[41] Bell Labs needed to focus on supporting its expansion of long-distance telephony with future computer designs, as well as designing computers for account billing. In 1947, computers that could be adapted for use in a variety of problems were just starting to be designed; they were not yet widely used for business applications.

After reviewing "mechanical brains that are mathematicians,"[42] Berkeley covered one that was a logician: The Kalin-Burkhart Logical-Truth Calculator. As he did with the Eniac, Berkeley referred to this machine in human terms, saying it was "fond of reasoning"[43] or determining the logical truth of a statement. He then covered principles of logic, first calculated using natural language (English) to solve insurance problems, and then using Boolean algebra applied to switching circuit design, with an example from Claude Shannon's work.[44] Berkeley recounted the story of Theodore A. Kalin and William Burkhart, who designed the Logical-Truth Calculator in 1946 while they were undergraduates at Harvard University. They applied Shannon's work to problems in mathematical logic and built a machine that would calculate truth tables. They demonstrated their machine in Cambridge in June 1947; in August, Berkeley had the machine moved to the Prudential offices to study its application for drafting contracts and calculating policy rules. Although the machine was inexpensive

39. Ibid., 134–135.

40. Ibid., 142.

41. Ibid., 143.

42. Ibid., 144.

43. Ibid., 144.

44. Berkeley referred to Shannon's 1937 work as a research assistant at MIT and a 1938 paper "A Symbolic Analysis of Relay and Switching Circuits," published in *Transactions of the American Institute of Electrical Engineers*.

and reliable, Berkeley found that a general ignorance of possible applications of mathematical logic prevented other people from recognizing the value of this machine for solving actuarial and other business problems. The Kalin-Burkhart Logical-Truth Calculator was not adopted at Prudential.

These giant brains had proven that they could handle information and carry out complex programs without human intervention more rapidly than human computers. But what did the future hold for the design of mechanical brains? Berkeley identified two important improvements on the horizon: improved storage devices (memory) and the ability to store programming internally. Five new computers were under development as of December 31, 1947: Harvard's Mark II and Mark III, IBM's Selective-Sequence Electronic Calculator, the Moore School's EDVAC, and Eckert-Mauchly's BINAC. At the end of 1947, Berkeley's Simon computer was the only device available to anyone who wanted to build a personal computer for home or office use. The other computers were large machines, each taking up a room of space and requiring many highly trained people to operate.

Berkeley envisioned that computers would be applied to a wide range of non-mathematical problems, like finding information in libraries, typing text from voice input, translating languages, and controlling other machines. On an individual level, he foresaw small-scale, personal computers with memory that average people could use to keep addresses and telephone numbers, calculate income taxes, and find and remember information. This mobile device would be "a small pocket instrument that we carry around with us, talking to it whenever we need to, and either storing information in it or receiving information from it. Thus the brain with a motor will guide and advise the man just as the armor with a motor carries and protects him."[45]

The last chapter of *Giant Brains* took on a more ominous tone, examining the topic of "Social Control: Machines that Think and How Society May Control Them." In this chapter, Berkeley argued that people needed to establish systems of control over these intelligent machines to ensure that they would be "of true benefit to all of humanity."[46] He argued that responsibility for implementing these controls should be shared by people everywhere:

> Now the problem of rational control over robot machines and other parts of the new technology is no respecter of national boundaries. To be solved it requires a world-wide point of view, a loyalty to human society and its best interests, a social point of view. . . . It is not easy to think of any yet organized group of people anywhere that

45. Berkeley, E., 1949, 195.

46. Ibid., 196.

would have both the strength and the vision needed to solve this problem through its own efforts. For example, a part of the United Nations might have some of the vision needed, but it does not have the power. . . . [W]e need a public body responsible for study, education, advice, and some measure of control. It might be something like an Atomic Energy Commission, Bacterial Defense Commission, Mental Health Commission, and Robot Machine Commission, all rolled into one."[47]

Problems of Language and Intelligence

Berkeley's emphasis on teaching people to work with "machines that handle information automatically" reflected a belief in science that characterized the post-World War II and Cold War years in the United States. Because technological progress and national security were central concerns of this post-war culture, Berkeley's work served an important societal function that helped to establish electronic computing as a legitimate profession separate from mathematics or engineering.

Technology development after World War II took place amid national debates about proper relationships among government agencies, research operations, private corporations, universities, the press, and the general citizenry. As the war wound down, Vannevar Bush—director of the U.S. Office of Scientific Research and Development (OSRD)—published "As We May Think" in the July 1945 *Atlantic Monthly* arguing that new devices were needed to help people keep track of the burgeoning mass of information: "The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square-rigged ships."[48] Bush reasoned that "[w]henever logical processes of thought are employed . . . there is an opportunity for the machine. . . . It is readily possible to construct a machine which will manipulate premises in accordance with formal logic, simply by the clever use of relay circuits."[49] In *Giant Brains,* Berkeley illustrated how Bush's predictions were becoming reality through small "mechanical brains" like Simon, a personal computer to help individuals handle information along the lines of Bush's Memex.

The information overload that Bush described was not merely an abstract problem. At the OSRD during World War II, Bush experienced a paperwork blizzard: "So many new government agencies had sprung up, demanding so much interagency coordination, that memos in triplicate were flooding the government. . . . Incredibly, a federal government that had entered the war with just $650,000 worth of printing

47. Ibid., 208.

48. Bush, V., 1945, 102.

49. Ibid., 104.

and reproducing equipment owned $50 million worth within a year."[50] Along with this challenge of handling massive amounts of information came the need to educate the general public about technological developments that impacted national security as we entered a Cold War with the Soviet Union. If new technologies such as radar, the proximity fuze, guided missiles, and the atomic bomb had made it possible for the Allies to emerge victorious from World War II, many U.S. leaders felt that rapid technological development and implementation was needed to protect democracy in the United States during the ensuing Cold War.

This rapid technological development and implementation required an informed and educated citizenry working within an environment of open communication. Harvard president James Conant described the importance of technological development, open communication, and education in these terms: "[W]hatever any other nation may do, whatever the tension of the times, we must continue to foster science; and that means fostering freedom of inquiry, of discussion, and of publication."[51] He did offer this caveat, though: "[T]he policy of the Communist party on the other side of the Iron Curtain requires the addition of a provision that the preceding description of scientific communication applies in the 1950s only to those who work in the free nations of the world."[52]

As the U.S. entered the Cold War, streamlined communication and communication technologies were seen as strategic to national defense initiatives.[53] Mina Rees, head of the Office of Naval Research (ONR) mathematics branch and founding ACM Executive Council member, commented on the need for better communication between branches of the military after the war ended: "The establishment of ONR at the end of World War II reflected the concern . . . that the vitality and momentum of wartime research would be lost in the postwar years and the level of civilian scientific research would be disastrously diminished."[54]

Berkeley, Rees, and their associates formed the ACM in large part to establish open channels for communication among computer developers working in business, the military, government, and the academy. While technical experts continued to develop machines that would help handle information and conduct business on a large scale, efforts were also underway to simplify the English language and facilitate the communication of technical information to the general public. Berkeley was aware

50. Zachary, G. P., 1999, 269.

51. Conant, J. B., 1951, 353.

52. Ibid., 22.

53. National Research Council, 1999.

54. Rees, M., 1987, 832.

of these efforts and employed Rudolf Flesch's writing techniques in *Giant Brains* to educate the public about the new computing machines through his book.

According to Flesch, modern non-fiction writing was primarily intended for general readers and/or for practical purposes. This perspective on the purpose of functional—or technical—writing reflected a larger concern with truth, propaganda, democracy, and national security in the post-war United States. In part, this concern manifested itself in debates about proper relationships among government agencies, research operations, private corporations, universities, the press, and the general citizenry. At the end of World War II, OSRD director Vannevar Bush grappled with tensions between a federally centralized model of technology development and the democratic tradition of the inspired inventor working in a private lab, like Thomas Edison. Reviewing his wartime work to centralize scientific research, Bush "considered the central moral achievement of the war the nation's reconciliation of the conflict between free men in a democratic society and the short-term benefits of tight control and command over a nation's resources."[55] The question of who would control technology development in the name of national security was central in determining what kind of nation we would become in the last half of the 20th century.

Technology development under a totalitarian, Communist government could potentially be more efficient than in a democracy, because decision-making was more streamlined. In a totalitarian regime, social decisions could be made by a few people; in a democracy, these decisions were subject to popular review and participation. If the United States was to successfully compete with the Soviet Union in the arena of technology development and national security, we had to streamline popular participation in decision-making processes when it came to implementing new technologies. One component of this undertaking was educating the average American about scientific and technical topics. An educated citizenry would be better prepared to understand and act on rapidly changing social, technological, and political situations to keep the U.S. on top in the Atomic Age.

Berkeley ended *Giant Brains*, with a supplement on "Words and Ideas," in which he clarified the purpose of his book: "to explain machines that think, without using technical words any more than necessary."[56] He described his simplified writing in the preface: "a count has been made of all the different words in the book that have two syllables or more, that are used for explaining, and that are not themselves defined. There are fewer than 1800 of these words."[57] By focusing on one- or two-syllable words that explain, Berkeley used his own version of Flesch's approach to make technical infor-

55. Zachary, G. P., 1999, 226.

56. Berkeley, E., 1949, 209.

57. Ibid., ix.

mation understandable for an average reader. Berkeley believed that "understanding" could be a "standard process" of collecting true statements about an idea,[58] carried out in three steps: find out what it is called; collect true statements about it; and apply those statements.[59] If "understanding" could be set out as a standard process to be repeated, then the implication was that machines could be taught to understand. And if language could be broken down into categories of words, computers could be programmed and taught ideas, using the principles of mathematical logic. Machines might be trained to use natural language and understand ideas.

Giant Brains ended with an extensive list of more than 250 books and papers relating to computers and "machines that think."[60] The extensive list included references for the Human Brain; Mathematical Biophysics; Languages: Words and Symbols for Thinking; Languages: Machines for Thinking; and resources for a number of specific machines, designs, and machine components. By including this long and specific list of references, Berkeley made a wealth of information on computer development available to the average reader in ways that a non-expert could understand.

Speaking of Machines as Human

When Berkeley set out to explain computers to people who did not know about them, he used a computer design principle from the Differential Analyzer at MIT: analogy. In explaining the Differential Analyzer, he used the example of a doorpost as an analogue measuring device when it is used to mark a child's changing height from year to year.[61] Analogue machines measured physical quantities that are "analogous to, or like, the information"[62] sought in a problem. Similarly in natural language, analogy is a powerful linguistic tool to help people understand new concepts by linking them to other concepts that are already familiar. In a talk "Analogy in Science," Robert Oppenheimer emphasized the utility of these comparisons for understanding new ideas: "[A]nalogy is inevitable in human thought because we come to new things in science with what equipment we have. . . . We cannot, coming into something new, deal with it except on the basis of the familiar and the old-fashioned . . . it is the freight with which we operate; it is the only equipment we have."[63]

58. Ibid., 212.
59. Ibid., 213.
60. Ibid., 228.
61. Ibid., 65.
62. Ibid., 65.
63. Oppenheim, R., 1956.

In order to help readers understand the many unfamiliar concepts involved in explaining computers in the 1940s, Berkeley used the analogy of human beings and machines to explain these "mechanical brains:" "For example, instead of 'capacity to store information' I have spoken of 'memory.''[64] In employing the linguistic tool of analogy, Berkeley drew on his background in symbolic logic, which relies on quantitative analogies,[65] and applied the same logical principles to natural language.

Berkeley went further than analogy in explaining computers, however. He talked about them as if they were human, a linguistic and psychological device called "anthropomorphism" or attributing human characteristics to nonhuman objects.[66] When Berkeley made statements like "Eniac grew to maturity, and in February 1946 he began to earn his own living by electronic thinking,"[67] he attributed characteristics of human growth to an inhuman, human-made machine. He also named Eniac's "father" as "the Ordnance Department of the U.S. Army, which provided the funds to feed and rear the prodigy."[68] By anthropomorphizing this machine, Berkeley intended to make new information about computers easier for general readers to understand: " Besides, to treat things as persons is a help in making any subject vivid and understandable, as every song writer and cartoonist illustrates . . . the crew on the first Harvard sequence-controlled calculator has often called her "Bessy, the Bessel engine."[69] But by claiming that computers could think and were human-like, Berkeley also implied that there were ethical issues inherent in our relationships with these machines[70]—that computer developers had social responsibilities similar to those of the parents of human children.

Berkeley certainly wasn't the only writer to call computers "brains" or to claim that these machines had human-like thinking powers. For example, a 1944 Westinghouse advertisement pictured their Network Calculator, calling it "a remarkable 'electrical

64. Berkeley, E., 1949, x.

65. See Robert Brumbaugh, "Aristotle as a Mathematician." *The Review of Metaphysics: A Philosophical Quarterly* 8, no. 3 (March 1955), pages 379–393 and Mary B. Hesse, "On Defining Analogy." *Proceedings of the Aristotelian Society, New Series* 60 (1959–1960), pages 79–100.

66. Adam Waytz, Nicholas Epley, and John T. Cacioppo, "Social Cognition Unbound: Insights into Anthropomorphism and Dehumanization," *Current Directions in Psychological Science* 19, no. 1 (2010), pages 58–62.

67. Berkeley, *Giant Brains*, page 113.

68. Ibid., page 113.

69. Ibid., page x.

70. Adam Waytz, "Does the Devil Really Wear Prada? The Psychology of Anthropomorphism and Dehumanization." *News Release from the Association for Psychological Science*, February 25, 2010 at http://www.psychologicalscience.org/media/releases/2010/waytz.cfm

brain' that enables an engineer to solve—*in a single hour*—intricate calculations that would take him more than 100 hours by mathematics."[71] A 1947 article on the Harvard Mark II in *Popular Science Monthly* was titled "Inside the Biggest Man-made Brain" and described this machine as "a mammoth electrical mathematician."[72] The Harvard machines were regularly referred to in the popular press as the "25-Ton 'Mechanical Brain,"'[73] the "Biggest Harvard 'Brain,"'[74] and the "Fabulous Robot Brain."[75] One headline even claimed that the "Mammoth Mechanical Brain Is Irked by Too Much Work."[76]

When introducing the Harvard Mark II at the January 1947 Symposium on Large-Scale Digital Calculating Machinery, Rear Admiral C. T. Joy adopted this analogy of "computer as brain" to express his enthusiasm for this new machine. Rear Admiral Joy was the commanding officer of the Dahlgren Naval Proving Ground where the Mark II would soon be installed. He described development of this machine in human terms:

> [A]lthough the Navy may have contributed, by material support and encouragement, some of the "tissue of this marvelous mechanical "brain," Professor Aiken and his staff must be given full credit for having supplied the "gray" matter. When Professor Aiken's creation has been completed and housed in a suitable "skull" at Dahlgren, I can assure you that we . . . are looking forward to the task of giving it something to think about.[77]

This idea of the calculating machine as a "giant mechanical brain" was a standard reference in common speech and in the popular press. But when Berkeley wrote about computers in human terms he ruffled the feathers of some colleagues. For example, in 1957 George Stibitz and Jules Larrivee authored a book, *Mathematics and Computers*, which had the same purpose as *Giant Brains*—to explain computers to the general public. Comparing the titles alone gives an indication of the different approaches

71. Westinghouse advertisement, *Science News Letter*, April 8, 1944 (SA).

72. Steven L. Freeland, "Inside the Biggest Man-made Brain," *Popular Science Monthly* 150, no. 5 (May 1947): 95 (GHP).

73. Anonymous, "25-Ton 'Mechanical Brain: Built at Harvard for Navy," *Boston Sunday Globe* (March 7, 1948) (GHP).

74. W. E. Playfair, "Biggest Harvard 'Brain' Tuned to Navy Rockets," *Boston Herald* (January 8, 1947), page 1 (GHP).

75. Paul Stevens, "Fabulous Robot Brain Now Works for Navy," *Boston Herald* (September 15, 1944), page 1 (GHP).

76. Anonymous, "Mammoth Mechanical Brain Is Irked by Too Much Work," *New York Herald Tribune* (January 12, 1947) (GHP).

77. Joy, C. T., 1948/1985, 4.

these authors took to their subject. In their preface, Stibitz and Larrivee made it clear that they did not consider computers to have human characteristics:

> We have tried to present the computers as sober, unintelligent, but useful tools in the increasingly important applications of mathematics to science, technology, and business, and not as the weird and superhuman intelligence of science fiction, the popular press, and less forgivably, of some scientific writers who should know better. We feel that these devices should be . . . recognized as members of a large family of machines that are helping to apply mathematics to an ever-increasing segment of mankind's problems . . . [78]

Although Stibitz and Larrivee sought to explain computers to the average reader, their writing style had a higher grade-level score using the Flesch Readability Formula and was less accessible than Berkeley's style. Whether you agree with Berkeley's anthropomorphism or not, his writing style and social intent consistently underpinned his message that the humans who developed these human-like, potentially intelligent machines have a responsibility to society for how these machines are used.

Bringing *Giant Brains* to the People

Berkeley worked on *Giant Brains* while he was employed at Prudential, and "there arose a considerable concern regarding its publication"[79] among company managers, who submitted the manuscript to Prudential's Law Department for review. They were specifically troubled by that last chapter on social control of the "robot-machine activities closely affecting public safety anywhere in the world."[80] Berkeley was asked to either omit the chapter entirely or omit any reference to Prudential. He chose to omit references to Prudential. But Prudential managers were not the only ones troubled by Berkeley's comments. Manuscript reviewers for Wiley Press also debated his ideas and pessimism.[81]

Berkeley's co-worker in the Methods Research Section warned that his comments could provide evidence that he was a Communist sympathizer: "It seems to me there is too much emphasis on eventual result of all "machines that think" (including many as yet undreamed of). . . . You run the risk of being accused . . . of attempting a social crusade. How much of this chapter would you be willing to see removed from its context and quoted "against" you? In this day of "Red-baiting" are you prepared to

78. Stibitz, G. R. & Larrivee, J., 1957, v.

79. Olmstead, B. E., no date.

80. Ibid., 10.

81. Berkeley, E., April 18, 1948.

be criticized for the words "Our friends, the peoples of Great Britain and of the Soviet Union" on page 12-16?"[82] In the published version of this chapter on "Social Control," Berkeley added this caveat in response to the reviewers' concerns:

> [A]lmost any conclusions about social control—including, certainly, the conclusions in this chapter—are subject to controversy. But controversy is good: it leads to thought. The more minds that go to work on solving the problem of social control over robot machines and other products of the new technology . . . the better off we all will be. If, while stimulating disagreement, the ideas expressed in this chapter should succeed in stimulating thought and deliberation, the purpose of this chapter will be well fulfilled.[83]

Berkeley's argument concerning the social control of technologies affecting human beings was essentially an argument in favor of the idea that computer developers have a social responsibility to benefit people rather than harm them. He believed that computer people should operate according to ethical standards, much as physicians are bound to uphold the Hippocratic Oath and use their knowledge to heal rather than harm.

By the time *Giant Brains* was published in November 1949, Berkeley had resigned from Prudential and started his own consulting business. He and Ruth were divorced in 1948; Berkeley married Susan Slocum Wallace from Newtonville, Massachusetts in 1949 and adopted her three children to his growing family. In his biographical sketch on the book's dust jacket, Berkeley's future looked bright:

> In 1946, Mr. Berkeley returned to the Prudential Insurance Co. as Senior Methods Analyst, later advancing to Chief Research Consultant. He took part in the exhaustive studies that led to Prudential's decision to buy a large-scale automatic computer, the UNIVAC. Since 1948 he has operated his own consulting service in the field of applications, marketing and uses of automatic machinery for handling information and computing. In his work Mr. Berkeley has traveled all over the United States to study automatic computers.[84]

Berkeley's acclaim grew. The *Newsweek* science editor reviewed the book in their December 12 issue, focusing on Berkeley's vision of a robot psychoanalyst to help humans "handle the tedious details of psychoanalysis." Overall, the *Newsweek* editor found the book "readable," noting that it "gives a remarkably clear picture of the

82. Mosesson, Z.I., March 8, 1948.

83. Berkeley, E., 1949, 197.

84. Ibid., dust jacket.

mathematical mind at work—both human and mechanical." He referred to Berkeley as a "brilliant mathematician and an authority on computing machines."[85]

Berkeley was interviewed for a January 10, 1950 *New York Times Book Review* article, which began with this quote: "I am descended from a long line of Frankensteins." Berkeley referred to the Eniac and Mark II computers as his forebears, then went on to describe the Simon "portable brain" he was working on: "There's no reason why a family-sized model can't be put on the market."[86] A *New York Herald Tribune* editorial titled *Giant Brains* an "appalling, yet fascinating, little book."[87] On receipt of the completed book, Rudolf Flesch wrote to Berkeley, " . . . you write beautiful prose. Somehow the combination of the chaste scientific style and childish simplicity is extraordinarily effective."[88] In a review of the book in the March 1950 *Journal of the Franklin Institute*, Emmett A. Mechler declared, "Mr. Berkeley has gone to great pains to write a popular and easily understood book about a complicated subject. . . . The description of an elementary relay computer having all the essentials of a large digital computer may entice some of his readers to build one of these devices. . . . This book has caused considerable discussion and it makes provocative and interesting reading."[89] *Giant Brains* also provided a springboard for Berkeley to publicize his work and popularize information about solving problems using Boolean logic on these new thinking machines.

The publication of *Giant Brains* and Berkeley's promotion of his projects drew attention of newspaper and magazine editors. By the mid-1950s, he had been featured in a number of national publications, along with his thinking machines and robots. Three of his small robots appeared on the covers of *Scientific American* and *Radio Electronics*: Simon (a miniature mechanical brain), Relay Moe (a tick-tack-toe machine with variable strategies), and Squee (an electronic robot squirrel). Stories about Berkeley's devices appeared in *Popular Science*, *Newsweek*, The *New York Times* and the *New York World Telegram*. The March 19, 1956 issue of *Life Magazine* featured a three-page story on Berkeley, Squee, Relay Moe, and the Geniac mail-order kit for building a small mechanical brain at home.[90] By working with these small intelligent machines, Berkeley believed that people could learn the fundamentals of large-scale computing: "We think that a good part of the job of learning about the important new development

85. Anonymous, 1949.

86. Dempsey, D., January 10, 1950.

87. Anonymous, no date.

88. Flesch, R., December 2, 1949.

89. Mechler, E. A., 1950.

90. Berkeley, E., April, 1956.

of machines that handle information automatically and reasonably may be accomplished by constructing and operating just such working models as these."[91]

Computing on a Small Scale

Berkeley worked with three collaborators to design and build the small, personal-sized computer he described in his book. Technician William A. Porter, who had worked on the Mark II machine at Harvard, built Simon, a 39-pound "midget electric brain . . . small enough to be understood completely by one man."[92] They worked with two electrical engineering graduate students from Columbia University, Robert A. Jensen, and Andrew Vall, and about $270 worth of materials and $270 worth of labor.[93] Simon was based on relay logic and employed 129 relays that were readily available at army surplus stores at that time. A Columbia University fact sheet called Simon "the smallest complete mechanical brain in existence."[94] This small computer cost under $1000 to construct and could be "carried around in one hand." It was simple enough that one person could build and operate the device, which made it useful for teaching and learning about computers and logic.

In the spring of 1950, Berkeley exhibited Simon during a press conference at Columbia University, calling it the "smallest complete mechanical brain" and a "curious mutation" compared to the room-sized, large-scale computers that were the norm at that time.[95] On May 22, 1950, Berkeley and his small computer were written up in a *Wall Street Journal* editorial entitled "Simple Simon." In August, a small article with a photo of Berkeley and Simon appeared in *Popular Science*.[96] Simon appeared in full color on the cover of the October, 1950 edition of *Radio-Electronics* with the caption "World's Smallest Electronic Brain." In the accompanying article, Berkeley explained that "Simon was designed and built to exhibit in simple understandable form the essential principles of any artificial brain. He will be useful in lecturing, educating, training, and entertaining."[97] He included diagrams and instructions so that readers could attempt to build their own small computers and use them to apply Boolean logic

91. Berkeley, E., December, 1956, 52.
92. Berkeley, E., & Jensen, R. A., October 1950, 29.
93. Berkeley, E., November, 1950.
94. Columbia University Public Information Office, May 18, 1950.
95. Berkeley, E., November, 1950, 40.
96. Anonymous, August, 1950.
97. Berkeley, E., & Jensen, R. A., October 1950, 29.

to questions formed with natural language. Altogether, Simon was covered in thirteen articles in *Radio-Electronics* from October 1950 to October 1951.[98]

In November, 1950, a full-color photograph of Simon was featured on the cover of *Scientific American*, with an accompanying article by Berkeley complete with diagrams and close-up photographs of the machine. He reiterated his message that Simon was a computer designed for students and other computer enthusiasts who did not have access to the large computers, which numbered less than a dozen, being used to solve complex mathematical problems: "We can hope that as time goes on the machines will become cheaper, less complicated, more easily operated and more accessible to students. Or we can build a really cheap, simple machine designed mainly to teach the student the fundamentals."[99] He hoped that by having personal experience using computers, students who would design future machines would have a better grasp of the "philosophical and social implications of machines that handle information."[100]

Berkeley ended the article by looking forward to a future in which people would routinely use small, personal computers: "Some day we may even have small computers in our homes, drawing their energy from electric-power lines like refrigerators or radios. These little robots may be slow, but they will think and act tirelessly. They may recall facts for us that we would have trouble remembering. . . . Schoolboys with homework may seek their help. . . . We may find the future full of small mechanical brains working about us."[101] By 1959, Berkeley had sold plans for building Simon to more than 400 computer enthusiasts.

Among those enthusiasts were three people who would go on to create the next generation of what became known as "personal computers." Wesley A. Clark, who later became known as a "father of the personal computer" after designing the TX-series and the LINC machines, credited Berkeley's Simon for inspiring Bert Sutherland,[102] Ivan Sutherland,[103] and himself to envision new avenues for programming:

98. Berkeley, E., December, 1951.

99. Berkeley, E., November, 1950, 40.

100. Ibid., 42.

101. Ibid., 42.

102. Bert Sutherland managed the Sun Microsystems Laboratories (1992–1998), the Systems Science Laboratory at Xerox PARC (1975–1981) and the Computer Science Division of Bolt, Beranek, and Newman, Inc., which helped develop the ARPANET. He included team members from fields such as psychology, cognitive science, and anthropology to include a social dimension to research activities. He participated in the development of advanced microprocessors, the Smalltalk and Java programming languages, and the Internet.

103. Ivan Sutherland developed the early graphical user interface Sketchpad, and is credited with inventing and developing the computer graphics field. He was awarded the Turing Award from the Association for Computing Machinery in 1988 and the Kyoto Prize in Advanced Technology in 2012.

> Did you know . . . that Bert and his brother Ivan were perhaps the first programmers of microcomputers? I'm referring to their experience with Edmund Berkeley's 'Simon,' the early relay system that some of you may remember. I first saw a picture of this wonderful little machine on a cover of *Scientific American* and I can tell you that, simple as it was, it influenced my life a great deal. Well, as I understand it, Bert and Ivan met Berkeley, and after a bit of programming, re-wired the machine and put in a table look-up multiplier. How about that? This was back in 1951 or 1952.[104]

Clark's recounting of his experience with Simon attests to the impact of Berkeley's devices on the future of computer development. That Ivan and Bert Sutherland also learned from and were inspired by Simon clearly shows Berkeley's influence on the development of personal computers, programming, and graphical user interfaces.

In an era when computers filled rooms and people worked at desks inside them, Berkeley set out to champion the possibilities of small, personal computers. After building the Simon, he designed and built the Geniac or Genius Almost-Automatic Computer, which he sold from 1955–1960 in mail-order kits for about twenty dollars. This small computer used rotary switches, dry cell batteries, and flashlight bulbs. It required the operator to manually turn the switches to obtain answers to a sequence of problems, such as the "Masculine-Feminine Tester," "The Space Ship Airlock," The Uranium Shipment and the Space Pirates," The Two Jealous Wives," and "The Fox, Hen, Corn, and Hired Man."[105] People could build a number of different devices with this kit and learn about computers from building circuits.

If Berkeley designed Geniac to be a tool for educators, it seemed to have some success in that area. In a 1958 issue of *The Mathematical Gazette*, H. Martyn Cundy published plans for a binary adding machine for use in classrooms, and credited his work with the Geniac as teaching him the fundamentals for building his own machine.[106] Writing in *The Phi Delta Kappan* in 1956, Daniel Davies covered "breakthroughs" in educational administration, in which he detailed twelve areas where new developments were having impacts on education. These included psychiatry, physiology, communication, and mathematics: "Boolean algebra is already at work in problem solving. One firm is advertising a kit for setting up an ingenious device known as *Geniac* which can quickly solve a wide range of problems involving multiple choices."[107]

Berkeley went on to design small computers named the Tyniac and the Weeniac, but did not make many copies of these designs. The next of Berkeley's popular small computers was the Brainac or Brain-Imitating Almost-Automatic Computer, which he

104. Clark, W. A., 1988, 347.

105. Lynn, Jr., H., August 1956.

106. Cundy, H. M., December 1958.

107. Davies, D. R., April 1956.

started marketing through mail-order kits in 1960. This machine was simpler than the Geniac and allowed users to do 50 experiments with electric circuits. In a 2012 opinion piece in *The Wall Street Journal*, David Deming, a geophysicist and associate professor of arts and sciences at the University of Oklahoma, remembered his first computer in "What I Learned From a Brainiac":

> We built our computers from kits and programmed them on our own. Instead of entertaining ourselves we developed critical thinking skills.
>
> For Christmas 1960, my brother received a BRAINIAC electric brain construction kit. . . . conceived, designed and marketed by American computer scientist Edmund Berkeley. . . . For $18.95, the purchaser received a kit containing pieces of Masonite pegboard, flashlight bulbs, nuts and bolts. Instructions included wiring diagrams for constructing a number of primitive computer circuits that could add, subtract, play tick-tack-toe and solve simple problems in logic. An advertisement described the computer as "fun to use and play with, and teaches you something new about electrical computing and reasoning circuits."
>
> Assembling the Brainiac was a challenge. Once it was built, you weren't done. The wires on it could be arranged into 170 different circuits. So the Brainiac kit taught problem-solving skills, both in its assembly and execution. If this wasn't challenging enough, the kit contained Edmund Berkeley's manual on Boolean Logic. There was little in this pamphlet that I comprehended.
>
> But that was all right. The very existence of the complicated technical materials notified us that there were vast worlds of information and learning to explore.[108]

Deming's first-person story of his experience with Berkeley's Brainiac computer kit, remembered 50 years later, attests to the impact these do-it-yourself "mechanical brains" had for some of the people who built them. In Deming's case, Berkeley accomplished his goal of making these small, personal computers available to people who would then learn from them and become the next generation of technology users and developers.

At a time when the conventional wisdom concerning computer development was "bigger is better" and each computer cost at least $100,000, Ed Berkeley championed the utility of small, inexpensive computers. In a paper he presented at the 1952 ACM conference, Berkeley argued that "it is possible to do important and interesting research and development in the field of automatic computing machinery for less than a tenth of that sum."[109] After reviewing a number of smaller computers with practical business applications, such as reading inventory tags or sorting addresses, Berkeley

108. Deming, D., February 12, 2012.

109. Berkeley, E., 1952, 107.

made a case for the development of ultra-small computers like Simon and others he described that played games, such as chess and Nim, or were used to study human reasoning.

Focusing on Simon, Berkeley pointed out that this ultra-small machine was "the most travelled" computer of its time, having been exhibited in New York, Seattle, Philadelphia, Boston, Washington, Detroit, Minneapolis, Pittsburgh, and other smaller cities.[110] The fact that Berkeley could take Simon from place to place meant that students and other non-experts could have "first-hand contact with automatic computing equipment in the flesh"[111] at these exhibitions. Back at home in his workshop, Berkeley employed both paid workers and part-time "members or partners in . . . our robot enterprise"[112] who were eligible for dividends shared from any income the ultra-small computers might generate. Berkeley found that this type of low-budget, non-traditional labor organization encouraged original thinking and efficiency.

A Preview of the Robot Age

From ultra-small computers, Berkeley branched out to building small robots. In 1951 he introduced Squee the mechanical squirrel, which could follow a light beam and pick up golf ball "nuts". Berkeley developed Squee with Jack Koff, an electrical engineering student at City College New York. He described that Squee "rolls over the floor, hunts for a 'nut' (a golf ball), picks it up in its 'hands' (a metal scoop in two halves), takes it over to its 'nest' (a metal plate), there leaves it, and then starts hunting for more nuts."[113] Berkeley saw Squee as a device for learning how to program problems, such as determining states of an apparatus and programming for changes in states when certain events happen.[114]

Berkeley wanted to "stir people's interest in the extraordinary possibility of robots"[115] and "display in a machine the kind of behavior that people ordinarily think only animals can carry out."[116] He made Squee available to robot enthusiasts by selling detailed construction plans through the mail. In December 1951, Squee the "Light

110. Ibid., 107–109.

111. Ibid., 109.

112. Ibid., 108.

113. Berkeley, E., June, 1952.

114. Berkeley, E., 1959, 177.

115. Anonymous, July 1952.

116. Berkeley, E. & Koff, J., March 1952.

Sensitive Electronic Beast" was featured in a full-color photo on the cover of *Radio-Electronics*. In the accompanying article, Berkeley described Squee as having "four sensing organs, three acting organs, and a small electronic and relay brain."[117] In this small machine, Berkeley attempted to push computers from being inert mathematicians into becoming active, sensing, and reasoning beings: "Although Squee is not a very clever robot, he does have a small amount of memory and of reasoning ability, and he is a close cousin of his predecessor Simon, the Midget Electric Brain."[118]

The *Radio-Electronics* article also included diagrams of Squee's parts and a chart of Boolean algebra rules, explaining ways to use Boolean logic for "dealing with circuit elements that can be 'on' or 'off"' and "connecting input and output to express the behavior of a robot or mechanical brain."[119] In a February 1952 *Radio-Electronics* article "Algebra in Electronic Design," Berkeley noted that engineers at Northrup Aircraft Company had "given up drawing circuit diagrams in many places because Boolean algebra does a better job" of helping them design circuits for "mechanical brains and robots."[120]

Squee was described in the August 27, 1951 edition of *Newsweek* and was featured in a two-page photo spread in the July 1952 *Popular Science*, which said, "This electronic animal behaves like a real squirrel."[121] In June of 1952, Berkeley published a 23-page exposition on "The Construction of Living Robots," in which he set out "the properties of robots and the properties of living beings, and . . . how to construct robots made out of hardware which will have the essential behavior of living beings."[122] He acknowledged that some people would object to the idea that mechanical devices could be described as having life, but Berkeley asserted that "with the great current development of robots and automatic computing machinery, it is important and worthwhile to bring up and discuss the subject of living robots."[123] Berkeley described robots as having "sensing organs, thinking organs, and acting organs. It is a machine that can adapt itself to some extent to its environment, doing different things depending on different conditions."[124] He pointed out that people already worked with robot process

117. Berkeley, E., December, 1951, 46.
118. Ibid., 46.
119. Ibid., 48.
120. Berkeley, E., February, 1952.
121. Anonymous, July 1952, 101.
122. Berkeley, E., June, 1952.
123. Ibid.
124. Ibid., 1.

controlling devices in oil refineries, robot piloting devices for aircraft, and automatic guidance systems for missiles.

In his plans and argument for constructing living robots, Berkeley pointed to a future in which more sophisticated machines would:

> preserve themselves, repair themselves, and reproduce themselves, [and] will as slaves or colleagues of men, open up unheard-of, unimagined ways for human beings to pursue their goals. . . . For example, think of exploring the bottom of the ocean, or the interior of volcanoes, or the surface of the moon, or the surface of Mars, with a swarm of such robots. . . . In fact, it is not beyond possibility that such robots already exist in present-day atomic energy or guided missile installations, hidden in unscientific secrecy. In fact, in a number of environments hostile or impossible for human beings or protoplasm life, living robots will in the future become useful, practical, and essential.[125]

Berkeley introduced this vision in a 1950 article in the *New York Times Magazine* entitled "2150 A.D.—Preview of the Robot Age." Berkeley explained how the thermostat controlling the furnace in a home was a kind of robot, with sensing organs and acting organs. From there, he described a more complex situation in which robots handled a job that was too dangerous for humans—the processing of rolled steel. Over the years, people had gone from employing machines in different stages of the process to automating the entire process with machines that could move the metal from one machine to another machine: "[I]nsruments were hitched up to the controls, via circuits that made the interconnection foolproof—free from random human mistakes. The whole factory became one robot machine."[126] If robots could take on the hazardous duty of rolling steel, why shouldn't people build robots that could handle weapons and go into combat, like the missile-delivering drone aircraft?

In 1950, Berkeley was "certain that robots are on the way . . . we must establish social control over them." He predicted that integration of robotic devices into people's lives would bring many benefits, such as better weather forecasting, use of solar energy instead of fossil fuels, robotic vehicles, computer-assisted educational tools, and machine translation. He also foresaw "communities planned for better living," "frequent excursions to Mars or Venus," and "psychological maturity"[127] accomplished by people working in tandem with intelligent machines. But he based these predictions on "the hope—which may prove groundless—that human intelligence can deal with

125. Ibid., 20.

126. Berkeley, E., November 19, 1950, 68.

127. Ibid., 75.

the great social and economic problems of our time, which the march of science is steadily intensifying."[128] It was a fading hope.

In 1961, Wiley & Sons published a second edition of *Giant Brains*, for which Berkeley wrote an afterword updating his comments from the 1940s. Comparing the total number of computers, he found, "In 1948 . . . only about six or eight automatic sequence-controlled calculators were operating. In 1961, over 10,000 automatic computers . . . are operating, each of them containing stored programs."[129] Comparing the total number of people working in the field, he found that "in 1949, there were perhaps 1000 or 1500 people actively engaged in the computer field. Now there are probably over 60,000 people. . . . [I]n 1961, the number of members of the Association for Computing Machinery was over 7000."[130] And the debate about whether computers could be applied to general purposes had been settled: "Computers are applied to the military evaluation of weapons systems, the reordering of supplies, the scheduling of shipments, translation from English to Russian or from Russian to English, playing checkers and other games of skill, and many other problems. . . . There is no argument now about the wide usefulness of these machines, or their capacity to assist human beings."[131]

In the midst of all this good news, however, Berkeley continued to warn of the dangers if computer people did not accept the social responsibilities for their actions. In updating the chapter on social control, he estimated the possibility of a darker future:

> At present writing, with the resumption of the testing of nuclear weapons by the Soviet Union and the United States after almost three years of moratorium, and the explosion by the Soviet Union of a 50 megaton nuclear weapon, it seems as if the obstacles of ignorance, prejudice, and a narrow point of view will continue to remain huge.
>
> Human beings will be very fortunate if they get through the next 100 years without a large-scale nuclear war between societies of man and the enormous destruction that will result therefrom. The nuclear weapons will be guided by computing mechanisms; the computing mechanisms will be designed by computer scientists; and the computer scientists will have contributed their essential share to the enormous destruction. . . .

128. Ibid., 75.

129. Berkeley, E., 1961a, 256.

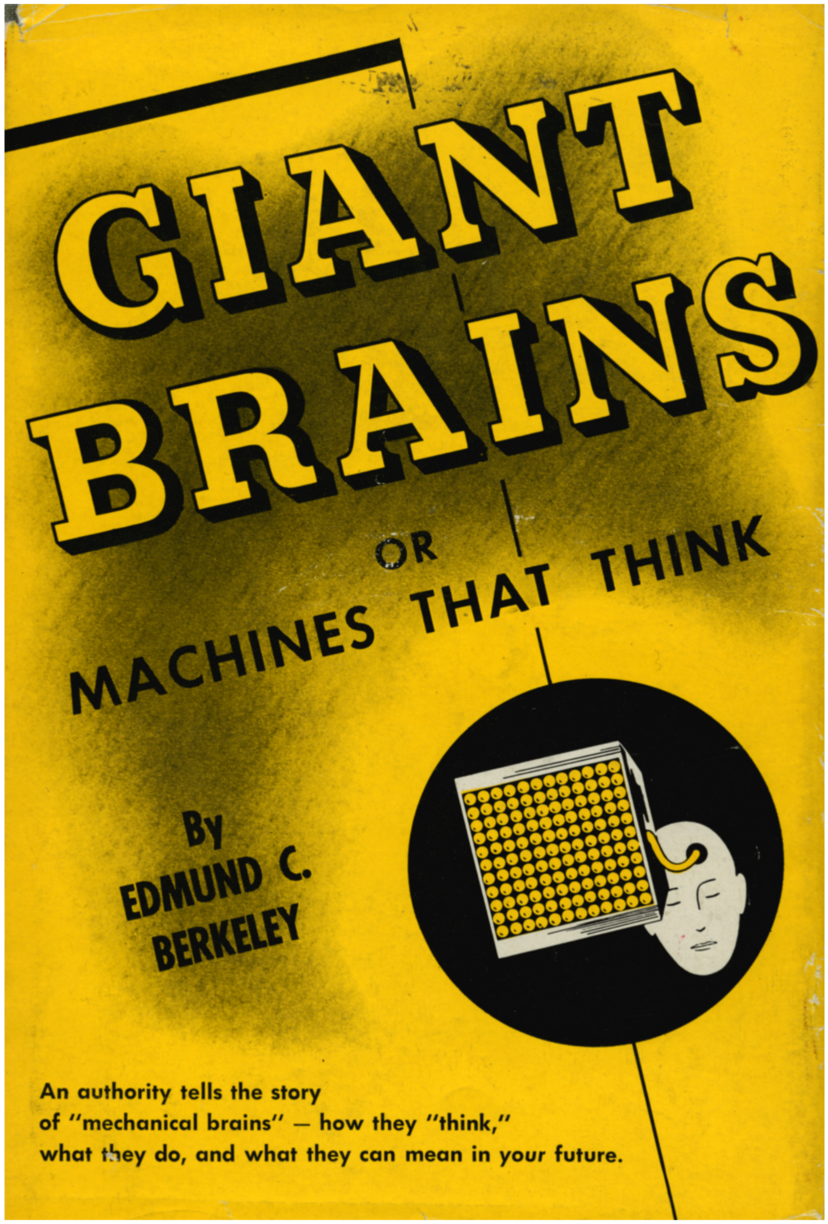
130. Ibid., 257.

131. Ibid., 257.

> It would be reasonable for every person, computer scientist or not, who sees these dangers clearly to devote a substantial portion of his time, energy, and resources to helping to prevent the logical lethal consequences of computers plus nuclear weapons plus rocket power. If human beings, under the United Nations or otherwise, can put nuclear weapons under effective control, humanity can start hoping again.[132]

Berkeley continued to hope for a brighter, more peaceful future. But the years between 1949 and 1961 challenged his ability to continue hoping.

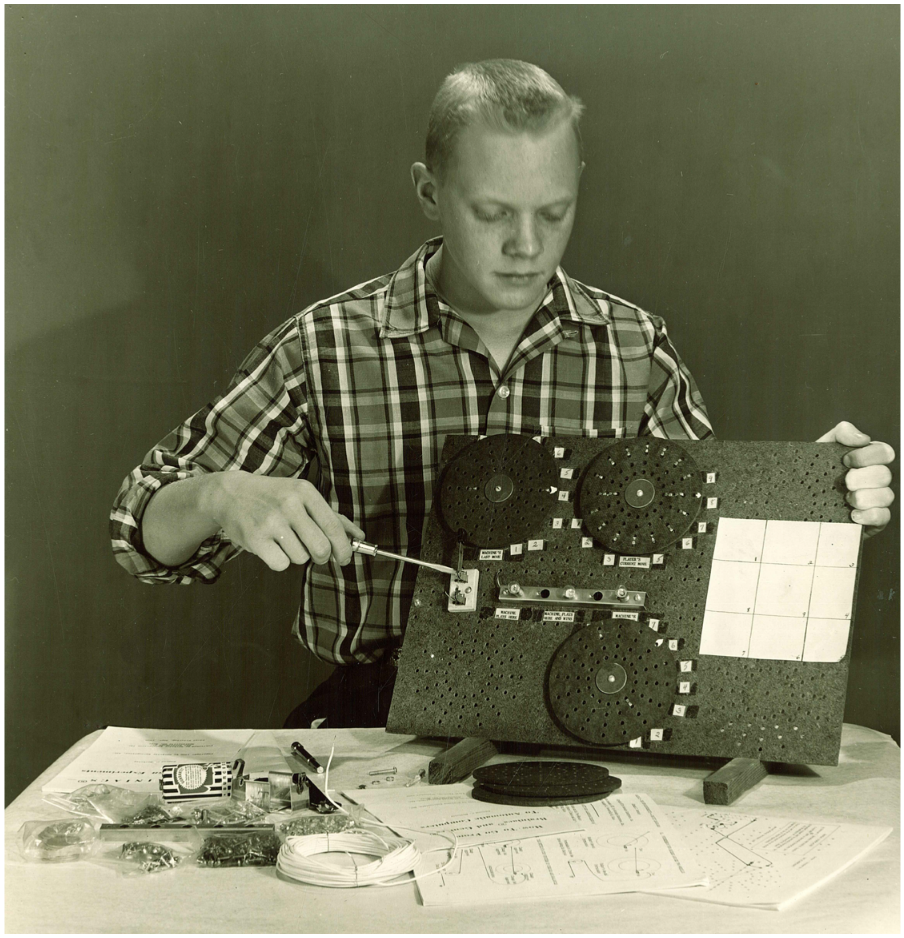
132. Ibid., 278–279.



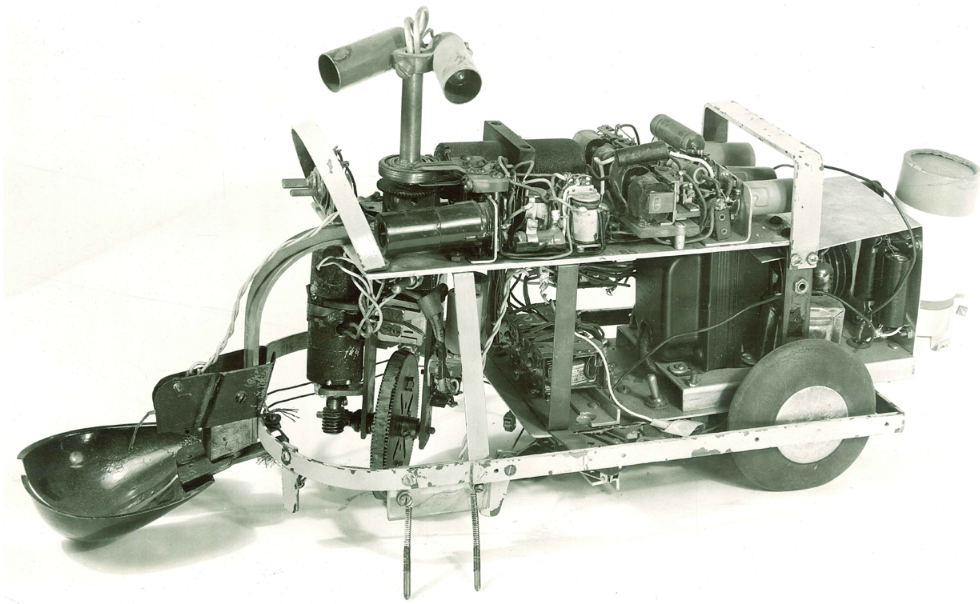
Original dust jacket for Giant Brains, 1949.

Berkeley explains how Simon gets instructions from a piece of punched tape. See *Radio-Electronics,* October 1950.

Cover from Brainiac kit, 1958.



Assembling the Brainiac.



Squee, the electronic robot squirrel, had two phototube eyes at the top of the steering post. The scoop in the front opened and closed to act as the robot's hands. See *Radio-Electronics,* December 1951.

Edmund and Suzanne Berkeley at their home, 1987.

5

National Security Investigations, 1948–1955

Every gun that is made, every warship launched, every rocket fired signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed. . . . This is not a way of life at all, in any true sense. Under the cloud of threatening war, it is humanity hanging from a cross of iron. . . . This is one of those times in the affairs of nations when the gravest choices must be made, if there is to be a turning toward a just and lasting peace.

—Dwight Eisenhower

With the onset of Cold War national security concerns after World War II, the Federal Bureau of Investigation began compiling files on U.S. citizens who served as military officers during the war. On 23 March 1948, a memorandum was prepared by an FBI agent in New York City; its subject was BERKELEY, Edmund Callis, Lt. Cdr. The memo was prepared as part of a report "Summaries of Information on U.S. Marine Corps and Navy Officers on Inactive Duty" sent to H. B. Fletcher, Special Agent in Charge of the Cleveland Division of the FBI. National security was top priority of the Cleveland Division during and after World War II. "Cleveland personnel provided extensive security checks for local war-related manufacturing plants, tracked rumors of enemy agents, investigated sabotage matters, and kept up with a wide variety of other criminal matters. . . . With the onset of the Cold War, the Cleveland Division's national security focus continued as it helped uncover hundreds of ideological agents working for Soviet intelligence."[2] The FBI agents in Cleveland opened Berkeley's FBI file with this

1. Eisenhower, D., April 16, 1953.

2. Federal Bureau of Investigation, no date-a.

routine 1948 memo. Over the next 30 years, his file grew to include information that questioned his associations and established him as a national security risk, leading him to secret military hearings.

The 1948 memo on Berkeley began with an error, listing his date of birth as 29 March 1909; he was actually born on 20 March 1909. The memo then listed a number of activities that would be of interest to agents in the FBI Cleveland Division:

> In 1930, while living at the International House in New York City, BERKELEY is reported to have been interested in communism. It was reliably reported that in 1934, BERKELEY and his wife, Ruth, visited Russia and that their names were included in a list of students at the summer session of the First Moscow University.
>
> It was reliably reported that he had served as Chairman of the New York Peace Association and later, of the American Peoples Mobilization Committee. He is further alleged to have admitted soliciting signatures and distributing circulars urging the defeat of the conscription bill of 1940 and to keep the United States out of war. BERKELEY has been associated with other communist front organizations and activities. . . .
>
> During the summer of 1944 . . . Berkeley . . . was listed as a correspondent concerning contributions with the National Council of American Soviet Friendship. . . .
>
> [Name deleted] also advised that Berkeley was a close associate of one [name deleted] who during the entire time he resided at Knickerbocker Village, wore a button which stated "I am a Communist."[3]

This information lay dormant in Berkeley's FBI file until early in 1951, when Admiral Sidney Souers asked for information about Berkeley. During World War II, Admiral Souers directed the Office of Naval Intelligence and in 1946 he was named as the first Director of the Central Intelligence Agency. From 1947–1950, he served as the first director of the National Security Council. In 1951, Admiral Souers was "special consultant to the President of the United States on problems affecting the nation's security."[4] Admiral Souers "said that he had been at a private gathering at which time a person in attendance said that the Navy should clean its skirts of a person such as Berkeley who is a reserve officer. It was based upon this allegation that Admiral Souers asked [name deleted] to have a name check made."[5] As a result of this request from President Truman's special consultant on national security, FBI agents expedited

3. Name deleted, March 23, 1948.

4. Truman, H. S., December 1, 1952.

5. Name deleted, March 23, 1948.

its check with informants regarding Edmund Berkeley, through the New York Field Division.[6]

On the Friday afternoon of January 14, 1955, Berkeley was in his office in New York City. He took a call from someone in the Navy Shore Patrol who asked if he could deliver an "official communication from the Navy" to Lieutenant Commander Edmund Berkeley.[7] Berkeley told the caller that he was leaving town shortly and they agreed to meet the following Tuesday afternoon, January 18, at 4:30 to complete the delivery. Berkeley later recalled that he "guessed that the Navy probably wished to deliver to me all my official Navy records in order to discontinue me from the Navy."[8] He pretty much forgot about the call until the following Tuesday, when a "very tall non-commissioned officer for the Navy Shore Patrol and an enlisted man, both of them strong and heavy, arrived together. They gave me a very large envelope, and had me sign for its delivery."[9] The envelope contained a memorandum from the Commandant of the Third Naval District, a statement of facts disclosed from an investigation of Berkeley's activities, a five-page list of questions for Berkeley to answer, and a form for Berkeley to sign resigning from the Navy "for the good of the service."[10] After reading the contents of the envelope, Berkeley was shocked, angry, perplexed and afraid.[11] The letter required his response by January 20; it was close to 5:00 p.m. on January 18 by the time Berkeley read the documents. He called the Third Naval District office and asked for more time to respond to the documents. They extended his deadline to January 27.

The subject of the memorandum was "Alleged activities, associations or attributes of security significance; opportunity to submit written answers to interrogatories and narrative statement."[12] It set out seven points questioning Berkeley's suitability to remain in the Naval Reserve:

1. Reference (a) [SecNavinst 5521.6 23 June 1954] . . . revises and restates naval loyalty and security policies . . . and prescribes the standards and criteria for separation of members of the Naval Service whose continued service is determined to be not clearly consistent with the interest of national security.

6. Ibid.

7. Berkeley, E., (1961b), 1-1.

8. Ibid., 1-1.

9. Ibid., 1-1.

10. Ibid., 1-3.

11. Ibid., 2-1.

12. Ibid., 1-2.

2. Reference (a) sets forth activities, associations and attributes which may be considered as establishing reasonable grounds for separation of personnel from the naval service in the interest of national security, including the following:

   > "Membership in, or affiliation or sympathetic association with, any foreign or domestic organization, association, movement, group or combination of persons which is totalitarian, Fascist, Communist, or subversive, or which has adopted, or shows, a policy of advocating or approving the commission of acts of force or violence . . . or which seeks to alter the form of government of the United States by unconstitutional means."

3. In compliance with provisions of reference (a), there has been prepared a narrative statement . . . of facts, revealed by investigation, indicating activities, associations, or attributes on your part similar to those described in paragraph 2 . . .
4. You are informed that you may consult counsel . . . you are at liberty to refuse to comment on the narrative statement or submit written answers to the interrogatories. . . .
5. All that is desired at this stage of the proceedings is a response, in your own words, to the best of your recollection, concerning the matters alleged in the narrative statement. Further action in your case will be governed, in some degree, by the nature of your response. If in your response a hearing is requested, such will be afforded, and therein you personally, with or without counsel, will have further opportunity to present relevant matter favorable to your interests. In the event no response is received by the date specified above, a local security board will convene . . . for the purpose of making findings of fact and rendering an opinion on such information as is available relative to whether your retention in the naval service is clearly consistent with the interests of national security.
6. You are also informed that for all administrative purposes, including possible administrative separation under conditions other than honorable, your failure or refusal to submit responsive answers regarding matters alleged in the narrative statement, or to any interrogatory, may be considered as an admission by you of the truth of any matter as to which a responsive reply is not made, and all derogatory inferences flowing therefrom.
7. Reference (a) . . . authorizes tender of resignation for the good of the service.[13]

13. Ibid., 1-2 to 1-3.

The narrative statement accompanying this memorandum set out four allegations, uncovered through field investigation, challenging Berkeley's suitability for Navy service due to national security concerns about his activities.

1. There is reliable information that Berkeley was a functionary of the New York Peace Association and the American People's Mobilization Committee. The California Committee on Un-American Activities has described the New York Peace Association as a Communist Front. The American Peace Mobilization has been designated by the U.S. Attorney General as an organization coming within the scope of Executive Order 10450. In 1943, the Special Committee on Un-American Activities issued the following statement concerning the American People's Mobilization. "Immediately after Hitler's invasion of Russia, the American Peace Mobilization changed its name to the American People's Mobilization, and reversed all of its former positions in exact accordance with the changes which Hitler's invasion of the Soviet Union occasioned in the line of the Communist Party."
2. Berkeley was reported to have been active in the Spanish Refugee Appeal and to have solicited contributions for the Spanish Refugee Appeal. There is reliable information that the Spanish Refugee Appeal was the name used by the Joint Anti-Fascist Refugee Committee for fund raising purposes. The Joint Anti-Fascist Refugee Committee has been designated by the U.S. Attorney General as an organization coming within the scope of Executive Order 10450.
3. Berkeley was reported to have:
   (a) constantly espoused the Communist Party line as late as 1948;
   (b) admitted soliciting signatures and distributing circulars in order to defeat the Conscription Bill of 1940 to keep the United States out of war;
   (c) frequently stated during the early stages of World War II that he felt that the United States should not enter the war. However, after the German armies invaded the Soviet Union he then came all out for a second front; and
   (d) became impressed with and sympathetic to Communism after traveling in Russia in 1934. The Communist Party, USA has been designated by the U.S. Attorney General as an organization coming within the scope of Executive Order 10450.
4. Berkeley's wife . . . was reported to have been a member of the American Labor Party in the borough of Manhattan, New York City in 1950. Reliable information indicates that the Communist Party controls the American Labor Party in the

> Manhattan and Brooklyn sections of New York City and has been a target for Communist infiltration and domination in the remainder of the state.[14]

The Interrogatory document went on to set out twelve questions and sub-questions in five more pages. These questions asked Berkeley to account for identifying information such as his date of birth, education, and employment since 1927. They asked him if he had "ever at any time in . . . [his] life been apprehended by civil or military authorities,"[15] the offenses, and whether he had been convicted of these offenses. They also asked him to name his current and any past wives, including "circumstances surrounding the dissolution or annulment in each instance."[16] These first six questions covered one page of the Interrogatory.

Question seven asked in depth about Berkeley's involvement with the New York Peace Association, the American People's Mobilization, and the Communist Party USA. His unnamed accusers alleged, "You were further reported to have stated frequently during the early stages of World War II that you felt that the United States should not enter the war. However, after the German armies invaded the Soviet Union, you were reported to have then come all out for a second front."[17] The Interrogatory then questioned when Berkeley had become interested in the New York Peace Association and the American People's Mobilization, who recruited him into these organizations, what type of indoctrination he received, what offices he held, what the aims of these organizations were, and whether he agreed with these aims. He was asked to supply names and addresses for other members of these organizations. The final section of this question addressed the alignment of these organization's activities with the Communist Party line:

> On 23 August 1939 with the signing of the Soviet-Nazi Non-Aggression Pact, the Communist Party precipitately discarded its collective-security curb-agressors [sic] line and suddenly adopted a new isolationist program. The Party officially dropped its anti-Nazi boycott and anti-Nazi propaganda disappeared from its press. The Communist Party proceeded to denounce President Roosevelt as a war-monger and attack the New Deal. Support of the Soviet Russian Peace Policy was declared paramount. On 21 June 1941 with the beginning of hostilities between Germany and Russia, this Communist Party "line" was completely reversed and all Communists were called upon to exert influence for an early American intervention against the Nazis.

14. Ibid., 1-4 to 1-5.

15. Ibid., 1-6.

16. Ibid., 1-6.

17. Ibid., 1-6 to 1-7. For a discussion of the background of the line of questioning connecting this political view with the Communist Party USA, see Evans, M. S., 2007, 58–59.

1. How can you explain your strict adherence to the Communist Party line over this issue? Were you merely an unwitting dupe or were you receiving instructions to take such a stand?
2. Did you consider the United States policy prior to 21 June 1941 as one of warmongering and intervening in a situation which was none of our affair? Why did you suddenly reverse your position after Germany attacked Russia? Is it not true that all Communist Party members were ordered to pursue this "line" at that time? Explain your answers in detail.[18]

Question eight addressed Berkeley's activities with the Spanish Refugee Appeal, including his activities to solicit contributions for this organization. They again asked when he became a member of this organization, from whom he received directions, what the aims of this organization were and whether he agreed with these aims. They asked him to provide names of other organization members. This question concluded, "In view of the fact that the Joint Anti-Fascist Refugee Committee has consistently adhered to the Communist Party line, do you feel there is any justification for existence of this organization in the United States?"[19]

Question nine interrogated Berkeley's Communist sympathies and alleged that he had ties with the Communist Party, USA:

> You were reported to have become impressed with and sympathetic to Communism after traveling in Russia in 1934, and to have constantly espoused the Communist Party line as late as 1948.
>
> (a) What caused you to become impressed with Communism during your trip to Russia in 1934? Did you attend any Soviet schools while you were in Russia? If so, what instructions did you receive?
>
> (b) Are you a member of the Communist Party, USA? If so, who recruited you and what type of indoctrination were you given? List the organizational units of the Communist Party, USA, with which you have been or are now associated and indicate the inclusive dates of the associations with each of these units. List any Communist Party book and card numbers, party aliases and any other identification which you have used while associated with the Communist Party, USA.
>
> (c) Are you in accord with the basic principles of Communism as expressed in the current Moscow enunciation of the Marxist-Leninist-Stalinist philosophy? Do you feel that membership in the Communist Party, USA is compatible with the

18. Ibid., 1-7 to 1-8.
19. Ibid., 1-8.

obligations you have as a citizen of the United States towards the preservation of its Democratic Institutions and its constitutional form of government?

(d) What is your opinion of the national and local legislation which provides the means for controlling the subversive activities of the Communist Party, USA? Do you feel that no control should be exercised over organizations which seek to overthrow the government of the United States by force and violence? If you object in any way to the spirit of this legislation, list your objections and your reasons therefor.

(e) What offices have you held in the organization of the Communist Party, USA and what are the inclusive dates during which you held these offices? What offices do you now hold and when did you first assume these offices? Give a detailed analysis of your responsibilities in each case to higher authority in the Communist Party, USA.

(f) Who are the members of the Communist Party with whom you have most closely associated during the period of your participation in the activities of the Communist Party, USA? List their names and addresses and the Communist Party book and card numbers, party aliases and any other identification used by these persons as members of the Communist Party, USA.

(g) Have you ever made your membership in the Communist Party, USA, a matter of public knowledge? If not, why have you felt it necessary to conceal your membership in this organization? Is it not an important indication of the conspiratorial nature of the Community Party, USA, that this organization has encouraged the formation of an underground apparatus? Explain your answers in detail.[20]

Question ten asked Berkeley to provide information about his wife's activities in the American Labor Party in Manhattan. Questions eleven and twelve addressed Berkeley's fitness to continue as an officer in the Naval Reserve:

11. Upon entering the United States Naval Reserve you took an oath in which you swore or affirmed to "support and defend the Constitution of the United States against all enemies, foreign and domestic," to "bear true faith and allegiance to the same," and you indicated that you took "this obligation freely without any mental reservation or purpose of evasion."

    (a) In view of the fact that you are still bound by this oath as a member of the United States Naval Reserve, how can you justify your participation in the activities of organizations which are dedicated to the overthrow by

20. Ibid., 1-8 to 1-10.

force and violence of the constitutionally established government of the United States?

12. Are you now or have you ever been a member of, prospective member of, contact of, or associated with any of the organizations proscribed by the U.S. Attorney General on the list of organizations issued pursuant to Executive Order 10450?

With this communication from the U.S. Navy, Berkeley was caught in a national security dragnet set to apprehend "Reds" and protect the United States from another world war that would probably become a nuclear holocaust. After all, the United States had already dropped two nuclear bombs on Japan in 1945 to end World War II in the Pacific. The Soviets had been testing nuclear weapons since 1949 and by 1953 had tested a 400-kiloton hydrogen bomb. Conventional wisdom in the early 1950s predicted that the next hot war would be nuclear. If the United States wanted to stay ahead in the arms race, it needed to protect technological secrets and national security.

Fighting the Communist Threat at Home

U.S. concern with Communist infiltration did not start with the Cold War. The Communist Party USA took shape in the early 1900s, an era of social unrest and change, with labor unions, Populists, Progressives, Socialists, muckrakers, and Left Wingers all putting forth their visions of a better future. It was formally established in September 1919, "forged by the industrial union movement of the 1910s, opposition to World War I, and the 1917 Bolshevik Revolution in Russia."[21] In the early 1920s, this movement was "transformed from a new expression of American radicalism to the American appendage of a Russian revolutionary power"[22] and members were active in labor and social welfare movements. In the 1920s, four-fifths of the approximately 10,000 American Communists lived in New York City, Chicago, Boston, Minneapolis, Cleveland, and Detroit.[23] "The first generation of American Communists grew to maturity in a world hospitable to every variety of radicalism. A later generation, which has grown to maturity in a world hospitable to every variety of conservatism, may find it difficult to enter into the spirit of this age of unrest."[24]

21. Filardo, P.M. & Nash, M., 2007.

22. Draper, T., 1957/1989, 395.

23. Ibid., 391.

24. Ibid., 49.

By 1929, the Communist Party USA had become an underground movement with a program “for ‘supplanting the existing capitalist government with a Soviet Government’ which would be a ‘dictatorship of the workers.”’[25] The “intellectual ferment” of those times fed the Communist Party USA as its members anticipated a revolutionary end to capitalism similar to what had taken place in Russia in 1917.[26] It was common to hear street orators in New York’s Lower East Side “hailing Socialism or Communism or Fascism as paths to national salvation.”[27]

In 1930, Congressman Hamilton Fish (Republican, New York) chaired a Special Committee to Investigate Communist Activities in the United States. His committee traveled the country for eight months and held hearings in cities from Washington, D.C. to Seattle to determine the extent of Communist infiltration into U.S. life. The committee’s report described the Communist Party USA to be “a militant revolutionary group, mostly headed by alien leaders and drawing on a membership base heavily weighted to recent emigres.”[28] A January 19, 1931 *New York Times* editorial stated, “The Chairman seems honestly to believe that there is imminent danger of a Communist revolution here, and that our Government and our institutions may be overthrown unless we adopt radical measures.”[29] The Fish Committee report recommended that the U.S. Department of Justice have more authority to investigate Communists, along with strengthening immigration and that deportation laws to keep Communists out of the country. These recommendations were not taken up by Congress, but “the rhetoric pioneered by Fish was used by his successors during the Cold War years to promote a climate of fear and repression.”[30]

In the mid-1930s, the Communist Party USA aligned itself more with “other leftward and conventionally liberal forces for reform and social justice, peace, and other noble projects.”[31] This new face of Communism attracted more progressive Americans into organizations that had Communist ties, often without their knowledge of these subversive associations. For ordinary U.S. citizens trying to cope with the hardships of the Great Depression, new socialist schemes emerged as viable alternatives to what seemed like a failing capitalist economy. “As ‘progressive’ ideas abounded, utopian schemes were preached on street corners, and notions of collectivist planning

25. Ibid., 389.
26. Evans, M. S., 2007, 64.
27. Arnow-Alman, E. & Alman, D., 2010, 9.
28. Evans, M. S., 2007, 51.
29. American Civil Liberties Union, May 1932.
30. Hoffer, C., no date.
31. Evans, M. S., 2007, 51.

espoused by many, the comrades seldom had much trouble merging their modified program with the general background noise of the decade."[32] Even such respectable figures as President Roosevelt's Interior Secretary Harold Ickes and First Lady Eleanor Roosevelt unknowingly lent their support to causes, such as the American Youth Congress, that were later revealed to have members who were also in the Community Party USA.

In 1938, the U.S. House of Representatives created the Un-American Activities Committee (HUAC) "to investigate alleged disloyalty and subversive activities on the part of private citizens, public employees, and those organizations suspected of having Communist ties,"[33] with Congressman Martin Dies (Democrat, Texas) as its first chair. Under Dies, the HUAC investigated what they thought could be Communist-front organizations and individuals suspected of being Communist agents. When the U.S. and the Soviet Union became allies in World War II, the need for vigilance against Communist infiltration increased as ties between the two countries tightened. After the war, this need for vigilance became critical as the Soviet Union expanded its control over Europe and Mao Zedong established a Communist government in mainland China. Then in 1950, Soviet-backed North Korea invaded American-backed South Korea and the U.S. sent troops under the auspices of the United Nations in an effort to contain Soviet expansion. To Americans in 1950, nearly half of the world map seemed to be covered by a red bloc of nations under Communist rule. And the bloc was growing. But Communist expansion was not only an international threat; Soviet agents also posed a threat within the United States.

The Rosenberg Case

This national security threat was exposed in 1950, when a U.S. Army enlisted man, David Greenglass, admitted to being a Soviet agent while he was employed from 1944–1945 as a machinist in the atomic weapons center at the Los Alamos lab. Greenglass was the brother of Ethel Rosenberg who, with her husband Julius, was accused of masterminding an espionage ring at Los Alamos to deliver information about the development of atomic weapons to Anatoli Yakovlev. According to FBI records, Yakovlev was a former Soviet vice-counsul in New York City who left the United States in December 1946.[34] Max Elitcher, a Naval Ordnance engineer and former classmate of Julius Rosenberg named another classmate, radar engineer Morton Sobell, as being involved

32. Ibid., 55.

33. Department of History, The George Washington University, no date.

34. Federal Bureau of Investigation, (no date-b).

in the espionage ring. Rosenberg, Elitcher, and Sobell all had electrical engineering degrees from City College New York; they all admitted to belonging to the Communist Party, USA.

Greenglass confessed to espionage conspiracy in June, 1950 and began to cooperate with investigators and prosecutors in New Mexico. He ultimately pled guilty to these charges in court and received a sentence of 15 years in prison. On July 17, 1950, Julius Rosenberg was arrested in his home at Knickerbocker Village in Manhattan's Lower East Side, where he and Ethel had lived since the 1940s. This was the same apartment complex where Edmund Berkeley and his wife Ruth had lived shortly after it opened in 1934. Knickerbocker Village was designed "to attract the young urban crowd of the times. . . . Many of the early residents were socialists and the complex was a hotbed of tenant activism at the time. . . . Newsletters of the period announced to the residents activities as diverse as a camera club, a fencing club, and meetings of the American Labor Party."[35] According to David Alman, who moved into the Village in 1941, the city block of 13-story brick apartment buildings was home to "mostly Democrats and Liberals with a 'vocal minority' of radical leftists including socialists, communists, and 'variations like Trotskyites."' Alman himself was a member of the Communist Party from 1937–1943. Alman described his politics as "'devout anti-capitalist' as a son of a Lower East Side Jewish merchant who saw landlords routinely evict tenants on his block and throw their furnishings on the street."[36]

Until the early 1940s, being a communist did not have the stigma it would come to have after World War II, when the social and political climate in the U.S. rapidly shifted from euphoria to suspicion as America's former ally consolidated its power in Europe and China. Dwight Eisenhower recalled that "the nations of the Free World were for only a short while a picture of joyous victory; too soon they reflected . . . black disillusionment. As time wore on, it appeared that the Soviet Union had no intention of continuing its policy of friendship, even on the surface." Instead, it became clear that Soviets were "holding occupied territory in bondage, while attempting to spread the growth of Communism through subversion, espionage, brutality, and fear."[37] President Truman established the National Security Council (NSC) in 1947 as a mechanism for integrating "domestic, foreign, and military policies relating to national security."[38] The NSC's first executive secretary, Sidney Souers, believed that in "the postwar period, the pace of events and their distressing direction sharpened the

35. Knickerbocker Village, no date.

36. Reinholz, M. December 26, 1012.

37. Eisenhower, D., 1963, 80.

38. Souers, S. W., June 1949, 534.

need for the creation of a mechanism to enable the executive branch to act quickly and judiciously in the face of problems involving our security and cutting across practically all fields of governmental responsibility."[39]

In 1949, the Soviets set off their first atomic explosion. In 1952 the United States set off our first hydrogen (fusion) bomb that was approximately 500 times as powerful as the atomic (fission) bomb. As Eisenhower faced election in November 1952, he knew it "was probable" that the Soviets would have a hydrogen bomb before long."[40] But our country's problems were not entirely of foreign origin. Eisenhower recalled that "numerous instances of malfeasance in office, disregard for fiscal responsibility, apparent governmental ignorance or apathy about the penetration of Communists in government, and a willingness to divide industrial America against itself had reduced the prestige of the United States and caused disillusionment and cynicism among our people. These I felt must be erased if we were to remain a people of self-respect, capable of governing ourselves in a world of strife."[41] After his election as U.S. President, Eisenhower took steps to address these domestic weaknesses and strengthen the country's international standing.

When Eisenhower got to his presidential office in January 1953, he found a document left for him by outgoing President Truman: "Submitted to the Department of Justice but not acted upon . . . was an appeal for executive clemency in the case of Julius and Ethel Rosenberg who, convicted of espionage against the United States, were under sentence of death."[42] Unlike David Greenglass who pled guilty to charges of espionage, the Rosenbergs pled not guilty and went to trial along with Morton Sobell, who had been a member of the American Peace Mobilization and joined the Communist Party in 1939 while working at the Navy Bureau of Ordnance in Washington, D.C. Sobell was convicted of espionage along with the Rosenbergs, but received a 30-year prison sentence instead of death. In 2008, at the age of 91, Sobell admitted that he and Julius Rosenberg stole classified, non-atomic information on radar and artillery devices and passed it along to Russian contacts.[43] He explained, "I helped an ally (admittedly illegally) during World War II. I chose not to cooperate with the government in 1950. The issues are now with the historians."[44]

39. Ibid., 534.

40. Eisenhower, D., 1963, 83.

41. Ibid., 83.

42. Ibid., 223.

43. Roberts, S. September 11, 2008.

44. Arnow-Alman, E. & Alman, D., 2010, 31.

Facing the need to decide whether to grant the Rosenberg's plea for executive clemency, Eisenhower decided against clemency, stating publicly that their crime "far exceeds that of the taking of the life of another citizen; it involves the deliberate betrayal of the entire nation and could very well result in the death of many, many thousands of innocent citizens."[45] In a private letter to a friend who was in favor of commuting the sentence to life imprisonment, Eisenhower explained more about his views regarding the need for a stronger stance against Communism:

> As to any intervention based on consideration of America's reputation or standing in the world, you have given the case for one side. What you did not suggest was the need for considering this kind of argument over and against the known convictions of Communist leaders that free governments—and especially the American government—are notoriously weak and fearful and that consequently subversive and other kinds of activity can be conducted against them with no real fear of dire punishment on the part of the perpetrator. It is, of course, important to the Communists to have this contention sustained and justified. . . .
>
> The action of these people has exposed to greater danger of death literally millions of our citizens. The very real question becomes "how far can this be permitted by a government that, regardless of every consideration of mercy and compassion, is also required to be a *just* government in serving the interests of all its citizens?"[46]

President Eisenhower was adamant that Soviet Communists should not view the U.S. as a weak adversary. He believed that all legal avenues had been exhausted. The Rosenbergs were executed at Sing Sing Federal Prison in Ossining, New York on June 19, 1953.

Shortly after his inauguration, Eisenhower took steps to tighten security regulations and minimize security risks among federal employees and military officers. He stipulated that "security rather than loyalty must be the test" of a person's suitability for employment or service.[47] He explained his reasoning: "[I]t is important to realize that many loyal Americans, by reason of instability, alcoholism, homosexuality, or previous tendencies to associate with Communist-front groups, are unintentional security risks."[48] On April 27, 1953, Eisenhower approved Executive Order (EO) 10450, which "eliminated the double standard of testing some [federal employees] as loyal citizens and others as security risks. No person could hold a job thereafter in the federal gov-

45. Eisenhower, D., 1963, 224.

46. Ibid., 225 note 1

47. Ibid., 309.

48. Ibid., 309.

ernment if his employment was not clearly consistent with the interests of national security."[49]

Acting under Executive Order 10450, federal personnel officers became agents for rooting out and terminating employees who were security risks. One such case, brought to light in the May 17, 1955 *Look Magazine*, involved Abraham Chasanow, a career federal employee who worked in the Navy Hydrographic Office in Maryland. On July 29, 1953, Chasanow was called into the Personnel Office, where he was suspended from his job following accusations of "associating with named 'known Communists,' of associating with named persons 'having Communistic tendencies' and of being 'a leader and very active in a radical group in Greenbelt, Md."'[50] In a panic, Chasanow packed up and left the building, wondering who had lied about him. All his performance evaluations had rated his work "excellent," and even "outstanding." "During and after World War II, he had located cracks in the Navy security system, and his recommendations for blocking them brought compliments from the Chief of Naval Operations."[51]

After being suspended, Chasanow said, "It seemed like the end, the end of everything we had ever hoped for and prayed for."[52] Upon hearing the news, Mrs. Chasanow closed all the blinds in the house to shield themselves from the outside world. They hired an attorney. They sought help from their rabbi. Their friends rallied around them. A news reporter from the *Washington Daily News* drew attention to Chasanow's case in a series of investigative articles. Chasanow said, "You feel as if you're in a dark cell. . . . You hate to step out of the house. You're afraid to talk to a soul." It was a "terrible nightmare."[53] Chasanow and his attorney fought the charges for over a year and on September 1, 1954 they got the news they hoped for: the Navy publicly cleared Chasanow's name and he returned to work with back pay. The Navy called the case a "grave injustice" and charged the informants with a "'disservice' to their country" after they were unable to corroborate their accusations on further questioning.[54] Chasanow said he felt like he "woke up from a bad dream and the sun was shining."[55] On April 7, 1954 Department of Defense Directive 5210.9 extended the Executive Order (EO) 10450 civilian employee security program to military personnel, including

49. Ibid., 309.

50. Blank, J. P., May 17, 1955, 25.

51. Ibid., 25.

52. Ibid., 26.

53. Ibid., 25.

54. Ibid., 29.

55. Ibid., 29.

those in the armed forces reserves.[56] For many people, like Edmund Berkeley, there was darkness on the horizon.

By 1955 when Berkeley received his communication from the U.S. Navy questioning his suitability to continue as an officer in the Naval Reserve, members of the Communist Party had been under "unremitting attack from government, anticommunist labor leaders, and business associations"[57] for more than a decade. "In the immediate post-World War II world, the outline of a nightmare had begun to take shape in the minds of many liberals, dissenters, Communists and independent thinkers. Failure to adhere to the prevailing models of political correctness was becoming synonymous with, at best, indifference to American values, or, at worst, with treason."[58] Berkeley became only one of a number of people whose beliefs were challenged by military and civilian review as President Eisenhower's administration tightened its national security guidelines.

Defense Against Unnamed Sources

Almost three weeks after Berkeley received the Navy's questions about his activities and Communist leanings, he had submitted his response and was notified that the Navy had assigned him counsel to meet with him and prepare for his hearing. When they initially met on February 2, 1955, his advocate said Berkeley's response gave him the "feeling that there is certain information that you do not wish to disclose." Berkeley reported later that he "laughed and said that was true." Berkeley's counsel told him that the hearing would be "very informal" and that he would be under oath.[59] At a subsequent meeting, Navy legal staff told Berkeley that "activities before entering the Naval service or activities of members of the family bear on security, but do not bear on loyalty."[60] Berkeley understood his task at the hearing to convince the panel of his loyalty, but not that he posed no security risk, despite the intent of EO 10450 that the Navy enforced. His military counsel assured Berkeley that in the approximately fifteen cases they had already reviewed, all the defendants had been awarded an honorable discharge if they testified at a hearing. Berkeley said this made him "feel a great deal better."[61]

56. Davis, C. R., July 1956, 3.

57. Murolo, P., March 1, 2009.

58. Arnow-Alman, E. & Alman, D., 2010, 31.

59. Berkeley, E., 1961b, 4-1.

60. Ibid., 4-5.

61. Ibid., 4-5.

Berkeley's hearing was set for February 16, 1955 and he used the two weeks before the hearing to prepare responses to the Interrogatory in consultation with his military and civilian lawyers. He made some notes to himself about what he needed to remember at the hearing. Among these points were, "Show your sympathies and full support to the United States. . . . You have to convince the Board of your loyalty—make a showing of loyalty to the United States under the present conditions. Right to confront my accusers and hear what they say in open court. . . . Right to be protected by the Constitution and laws of the United States."[62] In recounting the events of this hearing later, Berkeley added this final piece of advice: "Act as if you were wearing the uniform of the U.S. Navy, remembering how proud you were to wear it 1942–46."[63]

On the day of his Local Security Board hearing, Berkeley's civilian lawyer Leonard Boudin began by reading three objections into the hearing record:

> First, the charges as set forth in the narrative statement of facts are general in nature and lack details which are necessary for the respondent adequately to prepare for this hearing. . . . The second objection is that no evidence is being presented against the respondent. Despite the fact that the respondent now lacks the opportunity to examine the evidence against him and to cross-examine witnesses, the respondent is required to go forward and prove his innocence. Thirdly, I note that reference is made in the Narrative Statement to proscriptions made by the California Committee on Un-American Activities and the Attorney General. . . . Neither these proscriptions nor the statements of such committees have the force of law. As to the California Committee in particular, it . . . had become known as a purely political committee on a state level. . . . There are certain other constitutional objections to the procedure followed here.[64]

In his own opening remarks, Berkeley expressed regret that the hearing was necessary and called attention to the importance of such proceedings:

> But this hearing is important for two reasons—my own personal reasons of course, because I do not want to be discharged from the Navy under conditions other than honorable, and I do not think it is fair that I should be, without an opportunity to confront my accusers. The second reason why this hearing is important is that there are undoubtedly many other naval officers besides myself who have been caught up on this kind of proceeding, and from where we sit there is plenty of evidence that the charges are based on the statements of unknown shadowy informers, who may be utterly unreliable . . . [65]

62. Berkeley, E., February 10, 1955.

63. Berkeley, E., 1961b, 4-6.

64. United States Naval Review Board, February 16, 1955.

65. Ibid.

Berkeley asserted his loyalty to the United States and argued that he should be kept in the Naval Reserve where his expertise as an actuary and computer developer could be put to good use. He answered direct examination questions about his understanding of the term "national security: "I have never revealed in an improper way information classified from the military point of view. Furthermore because of my desire to write a lot and freely, and because one of the best ways to avoid telling something inadvertently is not to know it, I have avoided acquiring classified information, and since July 1946 I have consistently refused to have access to information classified from a military point of view."[66]

When asked about his views on the United Nations and the Cold War, Berkeley responded that he was "opposed to war" and "opposed to the cold war," which he wanted to see "replaced with some kind of coexistence." When asked about his trip to Russia in 1934, Berkeley recounted some of the places he visited, things he liked, and things he disliked among those he saw. When asked about his activities with peace associations, he stated that he did not remember much about his activities, but that he might have been involved in peace and anti-Fascist activities during the 1930s because he had been sympathetic to those causes.

Cross-examination questions asked Berkeley to provide information about his activities while he was a resident at Knickerbocker Village during 1938 and 1939. He was asked about his activities in the Knickerbocker Village Tenant Association, which he described as a group to "preserve the civil rights of the tenants and to put out a newspaper."[67] He was asked about his membership in the American Peace Mobilization Committee and other activist groups while at Knickerbocker Village, but Berkeley said he couldn't remember being active with those groups. He was asked to provide information on a resident of Knickerbocker Village, Paul Samburg, who allegedly wore a lapel button that said, "I am a Communist." Berkeley said he knew Mr. Samburg slightly while they both lived at Knickerbocker Village and refused to answer any more of the questions posed to him about this individual on the grounds that they were not addressed in the pre-hearing documents he received and were not pertinent to his case. He also refused to answer questions about attorney Nathan Dambroff, who had recently represented *National Guardian* editor Cedric Belfrage in Congressional hearings questioning the editor's Communist ties. Belfrage refused to answer espionage charges made by former Communist courier Elizabeth Bentley and was deported in 1954 on grounds of Communist Party membership.[68]

66. Ibid., 7.

67. Ibid., 15.

68. Fowler, G., June 22, 1990.

In his closing statement, Berkeley's military counsel stated,

> I would like to point out the character of the so-called evidence brought to light on the part of the government in this case by mere allegation, and to point out that the testimony of Mr. Berkeley was made under oath. He has testified that he knowingly would not join or support any organization Communist-controlled or desirous of overthrowing the government by force. He has testified that he is not a Communist. . . . He has testified that he has complete loyalty to the Navy. . . . He has expressed views on some matters that are controversial, for example the cold war and our relations with Russia. He has stated that his views on these matters change as conditions change. Such evidence or testimony has not blemished his record as a loyal citizen of the United States and as an honorable officer in Naval Reserve.[69]

The hearing ended, Berkeley returned to his office and "ate two sandwiches."[70] He felt that he "had fought a good fight" and was reassured that members of the board had come up to him after the hearing to shake his hand. Two hours later, Berkeley's military counsel called to say that after deliberating for less than five minutes, the local board recommended that Berkeley be retained in the Navy as an officer "whose retention was fully consistent with the interests of national security" and that he be given an honorable discharge if he desired it. Berkeley was happy to know that his troubles with the Navy were over.

But his troubles with the Navy were not over. Nearly five months after his Local Security Board hearing, Berkeley was notified by the Chief of Naval Personnel that on June 23, 1955, the Secretary of the Navy "approved the recommendation of a Board of Officers convened by competent authority that you be discharged from the U.S. Naval Reserve under honorable conditions."[71] The Navy gave him the option to submit his resignation within 30 days or the Navy would take administrative action to discharge him. Berkeley was angry: "Another board had apparently met in Washington . . . and had given me no opportunity whatever to put any information in front of them."[72] He sent a memo to the Chief of Naval Personnel asking for more information about this change in outcome from his Local Security Board hearing.

The Navy's decision to review the Local Security Board's decision in Berkeley's case was authorized under a 1954 Secretary of Navy order SECNAV 5521.6 setting out instructions for carrying out the EO10450 mandate in Navy and Marine Corps courts.

69. United States Naval Review Board, February 16, 1955, 20.

70. Berkeley, E., 1961b, 5–21.

71. Ibid., 6-2.

72. Ibid., 6-3.

According to these instructions, the Local Security Board sent their recommendations from Berkeley's hearing to the Secretary of the Navy, who was authorized to form a Department of Navy Security Review Board as a final review body. The instructions cautioned, however, "Referral of cases to these boards should be held to a minimum in instances other than those presenting substantial differences of opinion between or among members of other boards and/or . . . reviewing authorities."[73] Unbeknownst to Berkeley, his case had gone to the Secretary of the Navy for review.

On August 31, 1955, Berkeley received a memorandum from the Chief of Naval Personnel providing more information about this new outcome of his hearings. He first acknowledged Berkeley's understanding of the Local Security Board's recommendation, and then explained that "The Security Review Board which was convened . . . found upon review of the proceedings of the Local Board in conjunction with the investigative files and all other pertinent matter of record in the Navy Department concerning your background, service, and qualitative performance that your retention in the Naval service was not clearly consistent . . . "[74] The memo continued, "In amplification, it was found in review that, in answering certain written interrogatories propounded to you in advance of the proceedings, and to a lesser extent, in answering questions orally propounded to you at the hearing, you reserved the right to refuse to answer certain questions which you indicated you did not consider "pertinent" or as concerning "other persons". Furthermore, you expressed in some detail your best recollection as to some past activities in which you were personally engaged with significance from the standpoint of national security. Specifically, in the final review of your case, it was found that you had been active in and in sympathy with organizations inimical to the best interests of the United States."[75] The Chief of Naval Personnel informed Berkeley that he had the right to provide additional information for the Secretary of the Navy to review, and that he could appear in person before the Security Review Board. Berkeley chose to do that and traveled to Washington, D.C. to talk with staff in the Naval Personnel Office and prepare for the hearing.

On the train to Washington, Berkeley compiled a list of 22 questions and points to cover with people in the Naval Personnel Office. Some of these questions addressed his desire for further clarification of the intent of these hearings and his insistence on due process:

10. How many years back in my past is the Navy concerned with?

73. Secretary of the U.S. Navy, June 23, 1954.

74. Berkeley, E., 1961b, 6-5.

75. Ibid., 6-5.

11. Why do I have to be a stoolpigeon, an informer? . . .
14. Why can't I have a copy of the local security board hearing decision? . . .
16. Have any professional informers made statements about me?
17. Don't I have a right to confront my accusers and hear what they have to say in open court? . . .
19. Do I not have a right to specific accusations, and a right to be heard?
20. How much of my record can I see—why am I to be judged without knowing what I am being judged about?
21. How can I tell what is "additional new information" if I don't know what the old information was?
22. "active in and in sympathy with" organizations inimical to the best interests of the U.S.—what is the best way to disprove this?[76]

When he met with S. H. Crittenden, Deputy to Assistant Chief for Personnel Control (Performance and Security) and other personnel officers, he was told that although there had been no question about his loyalty, "it is all a question of security risk."[77] The review board felt that they "were not getting the full story," and that Berkeley "was not answering questions." It looked like he "was trying to conceal something."[78] Berkeley was told that there needed to be a "change in the presumption that . . . [he belonged] to organizations on the Attorney General's list" in order for his clearance to be reinstated. When it came to answering questions about people he had previously refused to talk about, Berkeley was told, "You have no duty to protect them, but you have a duty to aid the government by telling all that you know about them, everything that you can remember about these organizations." Berkeley was "astonished at these remarks."[79] His hearing was set for October 27, 1955 in Washington, D.C. His notification of the hearing included the following stipulations: " . . . all witnesses voluntarily appearing may be examined and cross-examined under oath on all matters germane to the purposes of the hearing. . . . As you are aware from previous experience, the proceedings of the board shall be in no sense of the word a trial or an adjudication; the technical rules of evidence shall not apply; matters presented, however, shall be

76. Ibid., 7-2.
77. Ibid., 7-3.
78. Ibid., 7-3.
79. Ibid., 7-3.

germane, reasonably concise, and neither cumulative nor redundant. No burden of proof whatsoever shall be borne by the Government."[80]

Berkeley's Bureau of Naval Personnel Officer Security Review Board hearing convened at 1:00 p.m. He faced the same three board members who reviewed the Local Security Board findings in his case on May 24, 1955 and found Berkeley to be a security risk. In his opening remarks, senior member Captain Cecil G. McKinney characterized the proceedings:

> [T]his is a purely informal conference-type of hearing—not a court-martial nor even a formal investigation. We don't worry about whether evidence may be opinion or hearsay. . . . [I]f you or your counsel feel that some question asked may be getting too personal, then just state that you would rather not discuss the matter. After all, we have no contempt powers, and cannot compel you to tell us anything more than your name, rank and duty station. . . . [T]o any extent that there is a burden of proof in this proceeding, it is on you. Unfortunately, security considerations do not permit indicating to you all the information which we have; and do not permit revealing sources of any such information. . . . [I]t is incumbent upon you to establish that you are a good security risk.
>
> It is not incumbent upon the Board to make out any case against you, and we won't attempt to do so. It is only fair to warn you that any presentation you may make to the Board and any questions you answer may furnish additional derogatory information which may be to your detriment. You are further warned that some questions may be asked you concerning matters which are fully known to the members of the Board, and that you may not be advised of or given an opportunity to explain any inconsistency or omissions perceived in your answers.[81]

According to these ground rules, Berkeley was guilty until he could prove his innocence and he did not have the opportunity to confront his accusers or review their allegations.

In his opening statement, Berkeley clarified the scope of the review hearing to be the years before he entered the Navy in 1942. There was no question about his character, his loyalty, or his activities during his military service from 1942–1946 or after he left the service. Under direct examination, he provided prepared answers to questions about his activities with the Spanish Refugee Appeal, his anti-war stance before Germany invaded Russia in 1941, his activities with the New York Peace Association and the American People's Mobilization Committee prior to 1941, and his attitudes

80. Chief of U.S. Naval Personnel, October 6, 1955.

81. Chief of U.S. Naval Personnel, no date, 2.

toward Russia and Communism. He provided more information about his activities while a tenant at Knickerbocker Village.

On cross-examination, the recorder/prosecutor repeatedly asked Berkeley questions about his participation in the Spanish Refugee Appeal, a group that the Attorney General had—long after the years in question—included on a list of Communist-front organizations. The recorder asked Berkeley to provide details about his attitudes towards peace, war, the Soviet Government, Communism and "the party line." Berkeley responded to more than 30 questions on these topics.

The recorder/prosecutor then turned to the topic of the two persons about whom Berkeley had refused to answer questions at his first hearing: Paul Samberg and Nathan Dambroff. The recorder asked, "Do you care to make any statements about them now? Not as to personality or as to their personal habits, vices or lack of vices, but as to any association they may have had with Communist? [Or] Communist-dominated organizations . . . you have omitted the answers previously and . . . we want to determine the basis clearly upon which you refuse to answer."[82] Berkeley responded,

> I can explain the basis for my refusal. In my opinion these persons have done nothing whatever criminal that I have known about, and it's contrary to my principles as an officer and a gentleman to give informant information about any such person. I simply cannot do it. I think it is wrong. Now if it can be shown that my relations with these people have some pertinence . . . whether or not my continued retention in the Navy is clearly consistent with the interests of national security, then you may perhaps put grounds before me which would make me say my view in this respect must be modified and I must answer some questions about them. But gentlemen, I do thoroughly believe that it is wrong for me to be an informant about these people and I think the only principal [sic] stand that I can take about these people is to say that I can't tell any information about them."[83]

The recorder continued to ask nine more questions about Paul Samberg and Berkeley continued to refuse to give information about him, saying "I don't think it's right."[84] Senior Member Captain McKinney called for a five-minute break. When the hearing reconvened at 2:45, the recorder continued asking Berkeley four more questions about Paul Samberg. This time the recorder (Lieutenant Commander Alfred G.

82. Ibid., 16.
83. Ibid., 16.
84. Ibid., 18.

Russillo) only asked Berkeley to provide factual information about when he knew Samberg and whether he had contact with him after Berkeley left Knickerbocker Village, which Berkeley had not.

Russillo then turned to questions about Nathan Dambroff,[85] asking if Berkeley knew him. Berkeley refused to answer whether he knew Dambroff, at one point saying, "The information that I know such and such a person is giving information about somebody else. Suppose this hearing board decided that I was unfit to be retained in the United States Navy. Then the fact that I knew him would cover him with a small amount of association, if it were true that I knew him. It would cover him with a small amount of contamination from me on the theory of guilt by association."[86] After twelve attempts to ask Berkeley whether he knew Dambroff, Russillo changed topics to ask about Berkeley's time at Knickerbocker Village.

Russillo repeatedly asked Berkeley to name all the organizations he belonged to while he was a tenant at Knickerbocker Village. After eleven questions along this line, Russillo asked, "Do I understand then that you belonged to an organization, an anti-Fascist organization of which you remember the name?" The questioning proceeded:

> RESPONDENT: I am very sure I belonged at one time to an anti-Fascist organization which was not mentioned in the Narrative Statement and which is on the Attorney General's list of subversive organizations and which you probably now are asking me for the name of.
>
> RECORDER: Certainly.
>
> RESPONDENT: And I feel that if I answer this question it leads directly into the informing aspect of this thing again and it bothers me. But again I will make an exception and name this organization. I am sure that I belonged to the American League Against War and Fascism. And I am sure that I subscribed to and received its periodical "The Fight Against War and Fascism", and I think the years that this was the case was probably around 1936 or '37 up to around 1938 or 1939. And having named this organization, I do not care to name anymore, because I think it leads directly into various types of questions about other people.
>
> RECORDER: Do you know who recruited you into this organization?

85. Anonymous, March 9, 1991: "Nathan Dambroff, a lawyer who specialized in civil rights, labor and housing cases, died on Thursday at his home in Scarsdale, N.Y. He was 83 years old. . . . Among his clients was Cedric H. Belfrage, publisher and founder of The National Guardian newspaper. Mr. Dambroff defended him unsuccessfully against deportation in the 1950's after Mr. Belfrage refused to tell Congressional investigators whether he was a member of the Communist Party. Mr. Belfrage was deported to Mexico."

86. Chief of U.S. Naval Personnel, no date, 18.

RESPONDENT: I don't know, and I don't remember being recruited into this organization. It seems to me I found out about it. It sounded sort of worthwhile to be in. I probably sent in a membership or something, two dollars a year and received their magazine.

RECORDER: Paid dues?

RESPONDENT: It might have been dues, it might have been subscription. I don't remember clearly. But I do remember being impressed with the American League Against War and Fascism at the time I was a member of it.

RECORDER: Well, I ask you again, now that it is proscribed and has been found to be a Communist front organization, do you think that its existence would be justified in the United States?

RESPONDENT: May I ask a slightly different question? If at the time I had known what I know now about the American League Against War and Fascism I would not have joined it. If at the time there had been an Attorney General's list stating that the American League Against War and Fascism was Communist controlled I would have taken that as a warning and a guide and I very likely would have nothing to do with such an organization, until I had satisfied myself that the Attorney General's list was mistaken in listing it.[87]

Russillo turned his questioning back to the Spanish refugee organizations, asking Berkeley to name organizations he belonged to. Berkeley responded by trying to provide some context for his activities during those years in the late 1930s in Knickerbocker Village:

If I could give the Board a picture of what was going on in those days, I think it would make it perhaps clearer. I was living in a very active community, Knickerbocker Village, with a lot of people stirred up about a lot of things. It was a very dramatic and exciting period of world history. A great many things to be stirred up about and lots of people would come to me from time to time and say will you do something in this direction, will you do something in that direction. Over and over again I agreed with the purposes, the ostensible purposes, of some of these organizations and I undoubtedly made some contributions to them. I tried to help in one way or another as it seemed to me I might be able to help and I felt the better for doing it because it was consistent with the beliefs that I was holding at that time. With regard to all this general category of organizations, if there had been any Attorney General's list as a warning I'd have been . . . done entirely different. If I knew then what I know

87. Ibid., 20–21.

> now about the Communist Party's motives and procedures, I would have behaved differently, I know.[88]

Russillo continued asking him about the Spanish refugee organizations and other organizations he belonged to while at Knickerbocker Village. He then addressed his questions to Berkeley's activities in the Knickerbocker Tenants Association, which Berkeley characterized as being about "civil rights of the tenants and . . . improving the lot of the tenants in the Village."[89] At one point, tenants had picketed the management office to protest the fact that the landlord had failed to renew some tenants' leases without stating a reason. This "meant that after a person became active in the Village and the landlord noticed them and decided there was anything about his behavior that the landlord did not especially like, the landlord, when his lease came up for renewal, would not renew the lease, and that person would be forced to move elsewhere and . . . would have been separated from the community where he wanted to live."[90] Berkeley had fallen into this category of tenants who did not have their leases renewed.

Russillo turned his attention to Berkeley's trip to Russia in 1934 and the economics course he took while he was there at the Anglo-American Summer Session of Moscow University. After Rusillo completed his questioning, other members of the board had an opportunity to ask their questions. One member asked why Berkeley could be so positive that he was not active with organizations during his enlistment from 1942–1946, when he had trouble remembering his activities before and after enlistment. Berkeley responded, "Well, I remember saying to myself when I went into the United States Navy that I had to change my way of behaving. In other words, I had to stop talking about controversial subjects, I had to stop having political and economic and other sorts of discussions with any people because nearly all the time I was wearing a Navy uniform."[91] The member continued with seven more questions about his political views and activities before World War II, before turning his attention back to Nathan Dambroff:

> "You were unwilling to discuss this man Nathan Dambroff. As far as I can see in your testimony that you read today, and at the hearing in the Third Naval District, you've been fairly willing to answer questions about associations and to a certain extent, about individuals. I'd like to ask you one question about Dambroff. Would you care

88. Ibid., 21.
89. Ibid., 22.
90. Ibid., 22.
91. Ibid., 23.

to tell this Board, when is the last time you had any association with this man, either by seeing him or by writing him a letter or anything of that nature? Have you seen him within or written him within the last ten years?"[92]

Berkeley answered, "I will answer that question and no more because it is contrary to my principles to give information about other people. Within the last ten years I have seen him."[93] The member went on to question Berkeley more about his unwillingness to provide information on Dambroff, finally asking, "If you were convinced that it would help you in your hearing before this Board to answer questions about Dambroff, would you still refuse to answer questions about your association with him?" Berkeley responded, "If my case hinged on my giving information about another person, I would not give that information. I would elect instead to resign and receive an honorable discharge. It is inconceivable to me that the standing of an officer in the United States Navy requires him to be an informer about other people."[94]

Questioning returned to the topic of Berkeley's activities in Knickerbocker Village and the tenant association there. After twelve more questions on that topic, the senior member of the board asked a few more questions about Berkeley's abstention from political activity while in the Navy. Before the questioning was complete, Berkeley asked for time to restate his position that he would not knowingly associate with people whose interests were detrimental to the United States or whose loyalty he would question. After a brief closing statement by Berkeley's counsel and one last question from Russillo about Berkeley's understanding of the Communist Party, the hearing ended three hours after it had begun and the board prepared its recommendation for the Secretary of the Navy.

On February 20, Berkeley received a memorandum from the Chief of Naval Personnel telling him that the "Secretary of the Navy desires that you be advised that a resignation from the United States Naval Reserve under honorable conditions submitted by you within thirty days . . . will be favorably acted upon; otherwise, administrative action will be taken to effect your discharge."[95] Berkeley wrote later, "I had lost the second round."[96] Berkeley wrote a letter to the Personnel Office asking that he be given a statement "that his loyalty to the United States is evident, and that his retention in the Navy is clearly consistent with the interests of national security, or an equivalent

92. Ibid., 24.

93. Ibid., 25.

94. Ibid., 25.

95. Chief of U.S. Naval Personnel, February 20, 1956.

96. Berkeley, E., 1961b, 9-2.

statement completely disposing of the charges."[97] The Chief of Naval Personnel wrote back, "The Secretary of the Navy, after review of all records . . . directed the action set forth" in the memo Berkeley received.[98] Berkeley called the Personnel Office and was told by someone there that the Secretary was not satisfied with his answers to the allegations, considering them neither "frank" nor "responsive." He was assured that this would not reflect on his service in the Navy, but that they would not issue him the statement that he requested.[99] Berkeley felt he had been "beaten."[100] He submitted his resignation and received an honorable discharge on March 24.

Reflecting on this episode some years later, Berkeley stated, "I still firmly believe that a man should be considered innocent until proved guilty. And that no administrative body of any government is in any way entitled to inflict losses of rights on a person without due process of law. And I believe that to be required to be an informer about some other person in the absence of good evidence that he has committed some kind of evil doing, is wrong, and destructive of the fabric of a free and proud society of individuals, and should be resisted with all the strength that one is able to muster."[101]

Questions of Constitutional Rights

Berkeley wasn't the only person concerned with due process in regard to these Naval hearings. For example, a July 1956 article in the *JAG Journal* posed these questions about military hearings arising from EO 10450: "[A]re there any limitations on the power of removal from Government service by the executive branch? does the individual concerned have the right go *confront* his accusers in removal proceedings? is *guilt by association* valid? what elements of *due process* must be accorded to the *individual concerned* in a removal proceeding?"[102] The author went on to cite two court cases which upheld due process relating to an individual's right to confront accusers and to protection from self-incrimination under the Fifth Amendment in these military administrative hearings.[103] In a 1956 decision, the U.S. Supreme Court acknowledged the personal danger inherent in personnel boards dismissing government employees on grounds of disloyalty: "Indeed, in view of the stigma attached to persons dismissed

97. Berkeley, E., February 27, 1956.

98. Chief of U.S. Naval Personnel, March 9, 1956.

99. Berkeley, E., March 14, 1956.

100. Berkeley, E., 1961b, 9-7.

101. Ibid., 9-12.

102. Davis, C. R., July 1956, page 3.

103. Ibid., 3.

on loyalty grounds, the need for procedural safeguards seems even greater than in other cases."[104] Commenting on administrative due process in military proceedings, Deputy Judge Advocate General of the Navy Robert D. Powers, Jr. stated, "There is no dichotomy or basic conflict between due process and efficient government or military necessity. The military serves to preserve the Constitution, including due process."[105]

In a case similar to Berkeley's, Robert O. Bland was a Lieutenant in the Naval Reserve who had served on active duty from 1942–1946 and had then gone on inactive duty. On December 29, 1955 Bland received a communication from the Navy alleging that his retention as an officer in the Naval Reserve was not consistent with the interests of national security. Like Berkeley, Bland was told that the Navy would consider a failure to answer the interrogatory questions as an admission of his guilt of the charges that he belonged to subversive groups from 1947–1950. Bland asked for and was granted a hearing in January 1956. Bland tried to resign from the Naval Reserve with an honorable discharge a week before the hearing, but the Navy did not accept his resignation. At his hearing, the Navy did not bring forth any evidence for the charges against Bland and he refused to testify. Instead, Bland sought relief from the District Court, asking that he be honorably discharged. The District Court refused to act. On appeal this decision was upheld in 1957 on the grounds that the "Navy did not lose the power of considering the fitness of Bland to hold a commission as an officer because of his inactive status." The court further commented that "the armed services are not required to tolerate the typical tergiversations of the alleged subversive."[106]

When the Naval Personnel Security Board reviewed the Local Security Board's findings, they recommended that Bland be issued a discharge "under conditions other than honorable" because they considered his failure to respond to the charges against him in the Narrative Statement and Interrogatory to be an admission that he had engaged in subversive activities posing a risk to national security. Bland went through Navy channels to have his record corrected and his discharge changed to honorable, but the Navy did not budge. Having exhausted all other avenues for relief, in February 1961 Bland filed an appeal with the U.S. Supreme Court, where his case was heard. The Justices found in favor of Bland, reversing the District Court decision and upholding Constitutional protections for due process and free speech:

> But were we to face the ultimate constitutional issue, we would be obligated to consider . . . the adverse impact of the exercise of such a power upon the dischargee

104. Powers, Jr., R. D., 1963, 20.

105. Ibid., 33.

106. United States Court of Appeals Ninth Circuit, March 28, 1957.

> in a proceeding which does not permit him to know or confront the witnesses against him. We think it must be conceded that any discharge characterized as less than honorable will result in serious injury. It not only means the loss of numerous benefits in both the federal and state systems, but it also results in an unmistakable social stigma which greatly limits the opportunities for both public and private civilian employment.
>
> . . . [W]e seriously doubt that the Constitution would condone the infliction of such injury, in the service of an interest so relatively weak, without the protection of the right of confrontation.
>
> Certain principles have remained relatively immutable in our jurisprudence. One of these is that where governmental action seriously injures an individual . . . the evidence used to prove the Government's case must be disclosed to the individual so that he has an opportunity to show that it is untrue. While this is important in the case of documentary evidence, it is even more important where the evidence consists of the testimony of individuals whose memory might be faulty or who, in fact, might be perjurers or persons motivated by malice, vindictiveness, intolerance, prejudice or jealousy.[107]

It took him six years, but in 1961 Robert Bland won an acknowledgement from the Supreme Court that the Navy Security Board hearings were stacked against the inactive reservists they sought to eliminate from their ranks on allegations that the reservists were security risks. Unlike more public hearings from congressional committees or federal agencies, these Navy hearings took place in secret where those accused had difficulties refuting vague charges from unnamed sources. But the personal outcomes were often the same: lost jobs and broken spirits. Dwight Eisenhower himself wrote about the costs these types of proceedings could exact from people caught in the dragnet. Of the hearings convened by Senator Joseph McCarthy, Eisenhower said:

> McCarthyism took its toll on many individuals and on the nation. No one was safe from charges recklessly made from inside the walls of congressional immunity. . . . Innocent people accused of Communist associations or party membership have not to this day [1963] been able to clear their names fully. For a few, of course, the cost was little . . . But where, without proof of guilt, or because of some accidental or early-in-life association with suspected persons, a man or woman had lost a job or the confidence and trust of superiors and associates, the cost was often tragic, both emotionally and occupationally.[108]

107. United States Court of Appeals, District of Columbia Circuit, February 14, 1961.

108. Eisenhower, D., 1963, 330–331.

Edmund Berkeley personally felt the stinging consequences of charges made against him from inside walls of military immunity and secrecy. But the purging processes that the U.S. government undertook during this period had larger societal consequences, in addition to the personal. This larger outcome is illustrated by another hearing that took place in 1954 concerning allegations that J. Robert Oppenheimer's associations and actions posed a risk to national security.

The Oppenheimer Case

On December 2, 1953, President Eisenhower received news from Secretary of Defense Wilson that he had received a report from FBI Director J. Edgar Hoover with allegations naming Dr. J. Robert Oppenheim as a Communist.[109] According to Eisenhower's description, Oppenheimer was a "brilliant scientist who had been a central figure in the development of the atomic bomb."[110] In 1953, Oppenheimer had been the Chair of the Atomic Energy Commission General Advisory Committee, was Director of the Institute for Advanced Study at Princeton, and represented the public face of atomic energy in the United States. In 1949 he had testified about his Communist affiliations at a hearing of the House Un-American Activities Committee. During the 1930s, for example, he had actively supported leftist causes such as support for the Spanish refugees. Oppenheimer had largely disassociated himself from his Communist acquaintances during World War II, but could not entirely disassociate himself from members of his family, friends, or former students who were members of the Communist Party. Until 1952, his accomplishments, influence, and charisma, along with support from President Truman, largely shielded him from attacks on his loyalty.

The Eisenhower administration ushered in a new ethos of military orderliness that required a stricter adherence to the chain of command. One of the new president's first projects was to reorder the White House staff relationships, clarifying reporting relationships and making operations more efficient.[111] The former general's penchant for orderliness and instrumental procedures brought a new clarity for determining who was acting within prescribed guidelines and who was not. This new clarity and military approach to administration fit well with the new type of Cold War that the nation waged after World War II—a relentless propaganda war that relied on internal security as its main weapon against Communist infiltration. This war for hearts

109. See Bernstein, B. J., July 1960.

110. Eisenhower, D., 1963, 310–331.

111. Ibid., 114ff.

and minds, in turn, relied on new military, psychological, and communication technologies being developed by scientists in the U.S. and the USSR. These scientists and technology developers had dangerous knowledge. To protect national security, it was critical that people with this dangerous knowledge, like Oppenheimer and Berkeley, be controlled within the guidelines of orderly administrative operations. However, control of the hearts and minds of the scientific community was inimical to its traditions of open, international exchange of information and activities. The need to control Oppenheimer's and Berkeley's opinions and actions can be seen as an outcome of the federal government's need to corral scientific minds within the secure boundaries of national administration.[112] The outcomes of these "normalizing" hearings had profound outcomes for many people and for technology development.

In June 1954, the three-person Atomic Energy Commission Personnel Board found Oppenheimer to be "loyal" and "discreet," but recommended two to one against restoring his suspended security clearance. The board's chairman, Gordon Gray, president of the University of North Carolina, and Thomas A. Morgan, former president of the Sperry Corporation, voted against restoring Oppenheimer's access to information deemed classified by the government. A minority report was filed by Dr. Ward V. Evans, chemistry professor at Loyola University in Chicago, who stated that the board's failure to clear Oppenheimer would be a "black mark on the escutcheon" of the United States. Coverage in the *Science News Letter* reported, "'Only time will prove whether he was wrong on the moral and political grounds' for which he opposed a crash development of the H-bomb pro-gram, Dr. Evans stated in his dissenting opinion." Dr. Evans also stated that "he was worried "about the effect an improper decision may have on the scientific development in our country," because the science of nuclear physics is new here and "most of our authorities in this field came from overseas. I would," he said, "very much regret any action to retard or hinder" the development of nuclear science."' [113]

After learning the verdict of his hearing Oppenheimer, who came to his hearing as a respected scientist and "father of the atomic bomb," "emerged from the trial broken, humiliated, and visibly aged by the experience."[114] He retreated to his post at the Institute for Advanced Study at Princeton and was largely a *persona non grata* in political circles until he received the Enrico Fermi Award from President Kennedy in 1963. He did, however, continue to speak and write on the social dangers of nuclear weapons. Oppenheimer's hearing made visible the danger that scientists in general

112. Thorpe, C., 2002.

113. Anonymous, June 12, 1954.

114. Ibid., 528.

posed for national security, as noted by sociologist Edward Shils in 1956: "Scientists, with their willful ways, their own world and their remoteness from the politicians' world stir anxiety."[115] As political scientist Morton Grodzins noted in that same year, "The professional guild from which a scientist acquires prestige and cues for action is confined to no national boundaries. . . . Scientists therefore tend to be internationalists."[116] The concept of national security and scientific exploration stir anxiety among government officials and scientists alike.

In March 1956 after receiving his honorable discharge from the Naval Reserves, Berkeley continued his work as a publisher and developer of "intelligent machines." He continued to be concerned with international affairs and was increasingly disturbed by threats to world peace that grew with U.S. efforts to stem Communism in Southeast Asia. But Navy Security Board hearings were not his last battle against allegations that he was a Communist sympathizer.

115. Qtd. in ibid., 530.

116. Ibid., 530.

6

Engineering Peace, 1948–1970

When I was a student of mathematics in England fifty years ago, one of my teachers was the great mathematician G. H. Hardy, who wrote a little book, A Mathematician's Apology, *explaining to the general public what mathematicians do. . . . He had strong views about technology, which he summarized in the statement "A science is said to be useful if its development tends to accentuate the existing inequalities in the distribution of wealth, or more directly promotes the destruction of human life." He wrote these words while war was raging around him.*

—Freeman Dyson

After Berkeley quit his job at Prudential in 1948, one of his plans was to organize a Research Group on Survival, with the goal of applying knowledge from "psychiatry, social anthropology, public relations, opinion analysis, military and other strategy" to achieve "maximum effect in the struggle for survival."[2] He proposed a series of topics under categories of war, public relations, people, and psychiatry, and set out this thesis for applying mathematical logic to problems of human survival: (1) In the struggle for survival, there are situations which occur over and over. (2) Therefore, they can be studied statistically and scientifically. (3) The results of these studies can be expressed in rules for guidance, in techniques for activity.[3] Berkeley envisioned that members of this group would be retained to help other citizens, politicians, conference organizers, and military planners make sound social decisions. He wrote a proposal to secure participation in and funding for this effort, which he called the Survival Bureau of Investigation.[4]

1. Dyson, F., 2006, 20.
2. Berkeley, E., June, 1948.
3. Ibid.
4. Ibid.

The Survival Bureau of Investigation did not get much support or funding, but Berkeley continued to be concerned with atomic politics and the threat of nuclear annihilation that grew increasingly serious as more nations developed atomic weapons. In February 1950, Berkeley met fellow actuary Max S. Weinstein, who encouraged Berkeley to write the book *The Hydrogen Bomb* in order to shed light on the existential threat from nuclear weapons. Berkeley knew he wasn't an expert on nuclear weapons per se, but Weinstein pointed out that Berkeley knew "a great deal about electronics," that he was an actuary with proven "proficiency in the field of logic," and that he could approach this as a concerned citizen addressing a political topic. "Your logic and your scientific knowledge lead you to the conclusion that we are in an impossible situation to which we must become awake before it is too late," Weinstein advised.[5] Berkeley concurred, saying that he wanted to write the book "so that 'the feet of the giant will stumble'."[6]

Over the next four months, Berkeley outlined the book and began writing chapters. He proposed the idea to editors at Macmillan, Simon and Schuster, and Doubleday. They were not interested in the book, even though Vannevar Bush's book *Modern Arms and Free Men* had recently been published and was selling well. Weinstein assured Berkeley that he had as much standing on this subject as Bush and encouraged Berkeley to keep working on the project: "[W]e don't achieve security by devising a terrible means of destruction. . . . Mr. Frankenstein didn't achieve security by creating his monster." With his letter, Weinstein included "two articles from 'The Worker' and a column by Walter Lippmann"[7] with pertinent information for Berkeley's book.

Berkeley abandoned *The Hydrogen Bomb* as a book project, but he did get one of the chapters on catastrophes published as an article in the *New York Times Magazine* on July 29, 1951 under the title "We Are Safer than We Think." In 1952, Berkeley published a report "The Chances of Human Survival or We Are Safer Than We Think" through Berkeley Enterprises, including additional information about threats (or actuarial risk) from nuclear war, genocide, and overpopulation.

Early in 1952, Dr. Michael Leyzorek of the Operations Research Office at Johns Hopkins University contacted Berkeley, inviting him to consult with that office. Leyzorek's invitation was based on Berkeley's work with information theory relating to "complex machine and system design." Leyzorek wrote, "Your recent published articles on the design of robots, computing machines, and other devices and systems, as understood in the light of communications theory, have attracted much favorable attention

5. Weinstein, M. S., February 23, 1950.

6. Berkeley, E., February 20, 1950. Also see Berkeley, E., February 18, 1950.

7. Weinstein, M. S., February 23, 1950.

here. . . . We are at work on a number of problems of a confidential nature for the Department of the Army, many of which may respond fruitfully to an attack based on the kind of systematic thinking which you have been doing."[8] Berkeley responded that his company had a policy of not accepting consulting jobs dealing with classified information:

> First, it is essential to us to remain entirely free to guess, talk, write, and publish about all facets of scientific information, without a shadow of reproach. Second, we believe that the loyalty and security procedures of the government have progressed to an extent that is basically harmful to the interests of science, and should be opposed by good citizens of a democracy. And finally, we are convinced that many problems with classified parameters can be replaced by substantially equivalent problems with science-fiction parameters, and thereby studied in an unclassified way.[9]

In a series of letters exchanged with Leyzorek, Berkeley elaborated his argument that scientific information should be openly exchanged:

> It is clear to us that scientific work in the United States is suffering increasing damage from indiscriminate, blanket acceptance of security practices. Some of the damage comes from losing sight of the fact that all security is relative; it is only a matter of time before the secrets of nature are deciphered by other investigators. Further damage comes from loss of communication. . . . The largest damage of all comes from laying scientists open to the attacks of demagogues. No amount of care can prevent some slips, and an unlimited number of investigations can always discover them. Shades of gray are indistinguishable to those who are determined to see black and white.[10]

Ultimately, Berkeley and Leyzorek were not able to come to an agreeable compromise for working with classified information and Berkeley declined the offer to consult with the Operations Research program at Johns Hopkins.

Berkeley did, though, become interested in operational research early in 1952 and began investigating this new field—"an applied science, extensively developed during World War II in the British and American armed forces" to provide "a quantitative basis for decisions" concerning equipment and human resources.[11] According to the National Research Council in 1951, principles developed for wartime military operations could be "fruitfully applied to business and industrial activities, and to those

8. Leyzorek, M., March 27, 1952.

9. Berkeley, E., April 3, 1952.

10. Berkeley, E., April 16, 1952.

11. Committee on Operations Research, April 1951, 1–2.

governmental activities which have an operational character."[12] Berkeley believed that these same principles could be fruitfully applied to political and social activities as well. He drew up an operational research program "devoted to providing informational ammunition and socialist analysis to Americans devoted to the cause of peace and socialism." He wrote, "This program of socialist Operations Research plans to apply that mixture of common sense, imagination and critical rigor known as the scientific method to some short-range and some long-range problems of American society at a time of increasing heat in the cold war."[13] By recruiting a cadre of scientists to this socialist operational research program, Berkeley proposed studying social, economic, and business problems, as well as questions in the emerging field of market research. He also proposed studying how they could "get rumors going about McCarthy and others,"[14] as well as "American youth and its attitude toward socialism."[15] Among the reactions Berkeley received to this proposal was that he would get in trouble from McCarthy's investigators.[16]

Berkeley Enterprises, Inc.

In the early 1950s, Berkeley established his consulting and publishing business with a national reputation for work with mathematics, logic, personal-sized computer kits, and small robots. He had completed short-term consulting positions to investigate how computers could be marketed to businesses and integrated into their operations. In particular, from 1949–1950 Berkeley studied how Barber Colman Company (Rockford, Illinois) could market a low-cost digital computer. In 1951 he conducted a similar study for Mergenthaler Linotype Company (Brooklyn, New York). From 1952–1953 he evaluated digital computers for possible integration into operations at Vitro Corporation of America (New York City). During these years, he also worked with Arthur Stedry Hansen Consulting Actuaries based in Lake Bluff, Illinois.

In 1951, Berkeley began to offer publications and technical courses by mail at reasonable cost for people who wanted to get into the fledgling electronic computer profession. He mimeographed and distributed three editions of the "Roster of Organizations in the Field of Automatic Computing Machinery" to share sources of innovation in the rapidly developing field. His correspondence courses gained enroll-

12. Ibid., 1.
13. Berkeley, E., February 19, 1952.
14. Berkeley, E., March 17, 1952.
15. Berkeley, E., February 19, 1952.
16. Berkeley, E., March 19, 1952.

ment and by 1955 had taught students from "fifty states and territories of the United States, and in twenty-four foreign countries: Argentina, Brazil, Canada, China, Cuba, England, Finland, France, Germany, Guatemala, Holland, Italy, Korea, Liberia, Mexico, Morocco, New Zealand, Pakistan, Persian Gulf, South Africa, Sweden, Switzerland, Venezuela, and West Indies."[17] His company offered a total of 28 courses in symbolic logic, language, computers and robots, operations research, statistics, mathematics, and general knowledge. Some titles of his courses were "Cybernetics," "Construction of Small Robots," "Automatic Computing Machinery," "The Algebra of Classes, and of States and Events, and How to Design Circuits with It," "Mathematics for People Who Didn't Like It," and "Readable Writing."[18] Through these correspondence courses, Berkeley sought to make information about computers and logic widely available. He even offered scholarships and reduced rates to people who organized study groups. These easily accessed courses helped to prepare workers in the growing computer industry.

In 1952, Berkeley began publishing a monthly journal for computer professionals under the title *The Computing Machinery Field*. A year later Berkeley renamed the journal *Computers and Automation*, then added the subtitle "Cybernetics, Robots, Automatic Control." In a 1952 article entitled "Communication and Control in the Computing Machinery Field," Berkeley argued that advances in machinery for "handling information automatically, or cybernetics," would bring a "revolution as great as the Industrial Revolution." He gave the name "information engineers" to people working in this new field, whether in "research, construction, applications, or just the pure science."[19] Berkeley saw the lack of free exchange of information as the greatest threat to the future of this field:

> We need control over our ways of communication so that each of us can find out easily what he wants to know. . . . Fortunately, the harmful effects of military security upon the free flow of information touches our field only in a minor way. We are largely free to communicate in full accord with the fine purpose put down in the constitution of the Association for Computing Machinery: "to advance the science, design, development, construction, and application of modern machinery for performing operations in mathematics, logic, statistics, and kindred fields, and to promote free interchange of information about such machinery in the best scientific tradition."[20]

17. Berkeley, E., November 1955, 9.

18. Ibid.

19. Berkeley, E., October, 1952, 14–15.

20. Ibid., 14.

Berkeley saw the design of human communication systems as having the same cybernetic nature as design of computerized information communication systems: "Both need to be the concern of information engineers."[21] In setting out his manifesto for information engineers, Berkeley claimed that human and computerized communication systems should both be the concern of people developing electronic computers. Communication systems—designed with both humans and computers—should be seen as inherently implicated in ethical concerns, because choices of audience, ideas, language, etc. necessarily include some people in the exchange and exclude others. Some people will benefit from the outcome of communication and others will not receive those benefits. Thus, Berkeley's argument held that because information engineers designed human-machine communication systems, they had social responsibilities for ethical practices regarding people as well as machines.

Berkeley also addressed ethical implications in technical training for people who would enter the field of information engineering. In a position paper entitled "Brains: Electronic and Otherwise" for the January 1953 issue of *The Computing Machinery Field*, Oak Ridge National Laboratory Chair A. S. Householder argued that although electronic computers had some intellect, people who worked with them realized "how essential is the human brain which directs their cerebration." He saw this need for "sound professional training" as essential "if our technological civilization is to thrive or even survive,"[22] and advocated strengthening local school systems to better prepare students for entering baccalaureate-level technical training programs. He noted that mathematical and engineering professional associations were also taking steps to train workers for the computing industry, indicating the importance of this growing profession. Berkeley returned to this topic of professional training intermittently in *Computers and Automation,* with articles like "Introducing Computers to Beginners" by Geoffrey Ashe from Ford Motor Company of Canada in the March 1954 issue and "What Is a Computer" by Neil Macdonald[23] in July 1954.

The Dawn of the Computer Age

According to the staff of *Business Week*, 1955 marked the turning point when the Computer Age started in earnest: "[M]any companies abandoned hesitancy, [and] began stepping up purchase of computers. . . . Alfred M. Wilson, executive vice-president of Minneapolis Honeywell Regulator Co., summed up the picture this way . . . 'more

21. Ibid., 15.

22. Householder, A. S., January, 1953, 8.

23. Neil Macdonald is Berkeley's pseudonym. See Weiss, E. A., 1995a.

progress has been made in the last year than in any year . . . previous." *Business Week* estimated that "about 3,000 machines of all sizes" were in operation, with "a rash of computer service centers" springing up and offering services to small businesses that could not afford their own computer.[24] In the pages of *Computers and Automation*, Berkeley presented lively discussions of how the integration of computers would affect people's lives in and out of business. His authors contributed articles that questioned how closely computer developers could mimic human brains in these electronic devices; they also reported news of new computer advances. For example, George J. Huebner, Jr. from the Chrysler Corporation described how computers were being applied to automobile engineering problems, but concluded that computers would not overtake human intelligence: "We have created in the new computers impressive and sometimes awe-inspiring tools; but no automatic device can evaluate, electronically or otherwise, the nuances which the human brain juggles and sorts continuously during its life span. We are completely ignorant of the input signals which man's brain automatically uses; and until we can specify them precisely we cannot introduce them into our tools." He ended with a long quote from the Rudyard Kipling poem "The Secret of the Machines," the last line of which read, "We [machines] are nothing more than children of your brain!"[25]

In the January 1956 issue of *Computers and Automation*, inventor Elliot L. Gruenberg contributed an article entitled "Machines and Religion," in which he explored the nature of humans and our machines through the lens of philosophy and literature. He ended with a statement of the hope—and threat—of the new intelligent machines: "The coming era of automation can afford even greater self-expression by overcoming the enslaving inconveniences of the body in greater measure, or,—and this is unfortunately possible—Man may lose his way, as he did after each of his prosperous ages; he may lose his concept of his function and sink in a welter of plenty."[26] In the mid-1950s, lively debates took place about the nature of human and machine intelligence, and the effects of automation on human systems. Would computers take jobs and dignity from people? Berkeley was in the thick of these discussions, often writing in *Computers and Automation* under his pseudonym Neil Macdonald. In "What Is a Computer?" Berkeley/Macdonald set forth his explanation of the "secret" of intelligent machines, stating that a "machine is perfectly well able to follow out a long series of instructions, performing reasonable operations, and adjusting them according to circumstances.

24. Staff of *Business Week*, September 1956, 15.

25. Huebner, Jr., G. J., November 1956, 48.

26. Gruenberg, E. L., January 1956, 45.

The application of this secret is destined to transform the world as we know it."[27] Once more people saw Berkeley's vision that machines could think in human terms, our lives would fundamentally change forever as machines took on human tasks and characteristics.

The world was, indeed, in the midst of a transformation. This same January 1956 issue of *Computers and Automation* included advertisements that highlighted the applications of computers for national security and Cold War preparedness. The Glenn L. Martin Company—manufacturer of aircraft, ballistic missiles, and rockets—advertised for simulation engineers to work at their Baltimore facility on projects employing "high speed digital logic, automatic control theory, and analog computation techniques."[28] Remington Rand Univac placed a full-page advertisement entitled "Launching Tomorrow's Satellite" that emphasized the application of the Univac Scientific Computing System for missile guidance systems: "When the first man-made satellite is launched on its orbit around the earth, it will owe its existence to the thousands of missiles which have preceded it and to the careful analysis of their patterns of flight. The Univac Scientific of Remington Rand has speeded this effort immeasurably, handling flight analyses for the nation's guided missile program."[29] An existential shift was taking place.

Engineering Weapons

On October 4, 1957 the Soviet Union launched Sputnik, the first artificial satellite to orbit around the earth. *Time Magazine* called the launch a "Red Triumph."[30] Although Sputnik was only the size of a football and contained transmitters, but no scientific instrumentation, its launch engendered "near-hysteria"[31] in the U.S. More than the satellite itself, the intercontinental ballistic missile (ICBM) that Soviets used to launch the orbiting device suggested that the USSR had surpassed the United States in the military arms race and was now poised to deliver nuclear weapons anywhere on the globe. *Newsweek* declared that Sputnik represented a "defeat in three fields: In pure science, in practical know-how, and in psychological Cold War."[32] The Space Race

27. Macdonald, N., January 1956, 46.
28. Martin Marietta, January 1956.
29. Remington Rand Univac, January 1956.
30. Science Editor, October 14, 1957.
31. Eisenhower, D., 1965, 211.
32. Qtd. in Osgood, K., 2006, 336.

was on and President Eisenhower was ready to reallocate federal resources to support missile and orbiter development.

Before October 1957, U.S. ballistic missile development—including the ICBM development headed by John von Neumann and intermediate-range ballistic missile development headed by MIT President James R. Killian—had been federally funded as military arms programs, not affiliated with earth satellite development. Satellite development, on the other hand, had been funded as a peaceful, scientific program affiliated with the International Geophysical Year agreement signed by 67 countries including the U.S. and USSR. This uncoordinated funding and reporting model left a gap between non-military satellite development and military development of the guided missiles that were needed to deliver satellites into Earth orbit, as well as deliver weapons to targets.

After Sputnik's successful launch, Americans asked how the U.S. could recover from this technological and psychological defeat. Edward Teller, popularly known as the "father of the H-bomb," warned that "the Russians can conquer us without fighting, through a growing scientific and technological preponderance. . . . If the Russians go ahead faster than we do in this direction, then we will be just helpless. If we are not able to use our freedom in the direction of accelerated progress, and if the Russians use their tyranny in this direction, they will win."[33] More than ever, developments in science and technology were tied to politics and defense. People in the fledgling electronic computer field were necessary for developing missile guidance systems that would help the U.S. establish superiority in space. The Eisenhower administration, seeking to restore confidence, announced on October 9, 1957 that the US would test launch the Navy's Project Vanguard satellite in December, even though he knew that the Vanguard missile was not yet ready to launch that satellite payload. Pressure was on development teams to meet this overly ambitious and politically critical deadline.

On November 2, 1957 the Russians launched a second, much larger satellite with an air-conditioned compartment for its passenger, the ill-fated dog named Laika.[34] On November 7, President Eisenhower received a report from a group of private citizens he had convened as The Security Resources Panel of the Office of Defense Mobilization Science Advisory Committee. The report, known as the "Gaither Report" after the

33. Anonymous, November 18, 1957.

34. Whitehouse, D., October 28, 2002: "The dog Laika, the first living creature to orbit the Earth, did not live nearly as long as Soviet officials led the world to believe. The animal, launched on a one-way trip on board Sputnik 2 in November 1957, was said to have died painlessly in orbit about a week after blast-off. Now, it has been revealed she died from overheating and panic just a few hours after the mission started."

panel's chairman H. Rowan Gaither, included studies of Soviet military and economic conditions. It found that although Soviet Gross National Product was one-third that of the U.S., their spending on armed forces and heavy industry equaled US spending in those sectors. Further, the Soviets had a significant stockpile of fissionable material and missiles. The panel predicted that by late 1959, the Soviets could launch a nuclear attack on the unprotected U.S. population and vulnerable Strategic Air Command bases.[35] Within days, this report became public and a sense of crisis heightened in the U.S. This crisis mentality deepened when the Vanguard satellite launch was first postponed, then launched at Cape Canaveral on December 6 before over one hundred newspaper and television reporters. "During the ignition sequence, the rocket rose about three feet above the platform, shook briefly, and disintegrated in flames."[36] The crash, with its fireball and billowing black smoke, was broadcast around the world on television and the world's media reacted:

> "COLD WAR PEARL HARBOR" (*San Francisco News*).
>
> "How about some relentless looking around for possible sabotage?" (*New York Daily News*).
>
> "Uncle Sam thought of launching a Sputnik into the sky. . . . The boastful and rich uncle called his Sputnik Vanguard. The name was beautiful and quite chic, but it turned out to be pshik" (Soviet Army's *Red Star*).
>
> "Soviet newspapers did not tell the world about any Sputnik misfires that may have preceded the first successful launching of an artificial earth satellite. This is the difference between an open government of the people and the closed rule of a police state" (*Des Moines Register*).
>
> "A very grave defeat for the American technique and industry" (Rome's Communist *L'Unita*).[37]

Amid a growing crisis of confidence, the Navy's Vanguard program was abandoned in favor of Project Explorer, an Army project begun for the International Geophysical Year under the direction of the charismatic, former Nazi rocket scientist Wernher von Braun.[38] Von Braun's team launched Explorer I into earth orbit on January 31,

35. Eisenhower, D., 1965, 220.

36. Launius, R. D., no date.

37. Anonymous, December 16, 1957.

38. A brief biography of Dr. Wernher von Braun is available from the Marshall Space Flight Center History Office at http://history.msfc.nasa.gov/vonbraun/bio.html.

1958 with a Geiger counter-like instrument built by astrophysicist James Van Allen[39] to measure radiation surrounding the earth. With data from this instrument, scientists were able to verify the existence of the Earth's magnetic field, which came to be called the Van Allen radiation belts.[40] Looking back on this period in his memoir *Waging Peace*, Dwight Eisenhower described this "period of anxiety:" "Sputnik had revealed the psychological vulnerability of our people. The Communists were steadily fomenting trouble and rattling sabers; our economy was sputtering somewhat, and the ceaseless and usually healthy self-criticism in which we of the United States indulge had brought a measure of genuine self-doubt."[41] If the U.S. was to wage peace, President Eisenhower called on the country's citizens to engineer missiles to compete with adversaries of freedom on earth and in space. Berkeley was already working to engineer peace, but did not necessarily believe that developing computerized weapons guidance systems was the best way to achieve that goal.

Total War and Works of Peace

In his January 1957 inaugural address, entitled "The Price of Peace," President Eisenhower called international Communism a "divisive force" with "dark" purposes to "seal forever the fate of those it has enslaved" and "break the ties that unite the free." He declared that the "solemn purpose" of the United States was the "building of a peace with justice in a world where moral law prevails" and predicted that "we have been warned, by the power of modern weapons, that peace may be the only climate possible for human life itself."[42] Berkeley, too, had been working to find a way for computer people to participate in building a peace with justice. He continued to believe that using computers to help solve complex social problems was more valuable than developing weapons to achieve this goal. Waging peace was the social responsibility of computer people.

In President Eisenhower's 1958 State of the Union address, he seemed to support a focus on technology development for peaceful purposes when he asserted that the "only answer to a [Soviet] regime that wages total cold war is to wage total peace." He called for the nation to apply "every asset of our personal and national lives upon the task of building the conditions in which security and peace can grow." But Eisenhower's vision for peace relied on military power, which "serves the cause of peace

39. A brief biography of James A. Van Allen is available from National Aeronautics and Space Administration at http://history.nasa.gov/sputnik/vanallen.html.

40. Launius, R. D., no date.

41. Eisenhower, D., 1965, 226.

42. Eisenhower, D., January 21, 1957.

by holding up a shield behind which the patient constructive work of peace can go on." The President focused on the development of intercontinental and intermediate-range ballistic missiles as being "particularly important," especially because at that time the U.S. was "somewhat behind the Soviets" in missile development and deployment. Developing these missiles relied on computer people to design the guidance systems that delivered warheads to their intended targets. Eisenhower called on technology developers to work for the nation's economic and political security: "Admittedly, most of us did not anticipate the psychological impact upon the world of the launching of the first earth satellite. Let us not make the same kind of mistake in another field, by failing to anticipate the much more serious impact of the Soviet economic offensive."[43]

In this State of the Union address encouraging computer people to develop weapons guidance systems, Eisenhower also challenged the world's scientists to share information in an open, cooperative communication network he called "Science for Peace." In a message he directed especially to people in the Soviet Union, Eisenhower made a plea for open exchange of scientific information to work toward world peace:

> The world must stop the present plunge toward more and more destructive weapons of war, and turn the corner that will start our steps firmly on the path toward lasting peace. . . . Our greatest hope for success lies in a universal fact: the people of the world . . . have always wanted peace and want peace now. . . . For a start our people should learn to know each other better. Recent negotiations in Washington have provided a basis in principle for greater freedom of communication and exchange of people. . . . A program of Science for Peace might provide a means of funneling into one place the results of research from scientists everywhere and from there making it available to all parts of the world. . . . But of all the works of peace, none is more needed now than a real first step toward disarmament.[44]

In this address, President Eisenhower seemed to encourage many of the ideas that Berkeley had been working toward since the mid-1940s: friendship with Russia; open exchange of information about science and technology development through international groups like the Association of Computing Machinery; using computers for improving people's lives rather than for destroying life; and encouraging nuclear disarmament rather than the proliferation of nuclear weapons.

As the year turned from 1957 to 1958, Berkeley penned "The Meaning of a Lasting Peace to Me." Like Eisenhower's vision of peace, Berkeley's lasting peace would

43. Eisenhower, D., January 9, 1958.

44. Ibid.

be based on free movement of people and exchange of information. It would not, however, be primarily concerned with missiles and military assets. Berkeley wrote, "I am thinking of a peace where gradually all the reasons for fighting wars between nations . . . are eliminated, and where the spreading of hatred among nations . . . has been abandoned, and where there are no headlines 'Russia is threatening the peace' or 'The United States is rattling a sword' . . . as if these great countries were behaving like little boys in a backyard."[45] President Eisenhower had called for working with international groups to share information and to work for disarmament. Berkeley sought to do this work of peace through his involvement with groups such as the American Friends Service Committee (AFSC) and the Society for Social Responsibility of Science (SSRS).

Berkeley copied items that were of special interest to him, and at the end of 1957 he saved a letter to the editor of the Society for Social Responsibility that was printed in that organization's *Science News Letter*. The letter, written by Dr. Herbert Jehle, from the Department of Physics at the University of Nebraska, included this advice from British physician and SSRS member Alex Comfort:

> I feel that the time has come when we could very usefully consider not an approach to governments, but a formal approach to our scientific colleagues in military projects, inviting them to resign on ethical grounds. Even if we got few resignations, we might get quite a few people thinking, and I am certain that the state of scientific morale both here and in your country is not so secure but that a little judicious shaking might bring about quite a few defections from unethical and psychopathological projects."[46]

Comfort's call for action made a lasting impression on Berkeley, and he sought to create a network of 1000–1500 people under the auspices of a group called Technical Committee on Ways and Means to a Lasting Peace. His plan was to apply "operations research and scientific method to obtaining a lasting peace;" he looked for five people to work with him on this project. He met with Harvard professor Everett Mendelsohn, who was the chair of Peace Education of the New England AFSC, and they discussed how Berkeley's committee could add to the progressive work that blacklisted journalist I.F. Stone carried out through his independent newsletter *I. F. Stone's Weekly*. Mendelsohn was "wary of getting into new movements."[47]

45. Berkeley, E., December 31, 1957.
46. Berkeley, E., November, 1957.
47. Berkeley, E., January 1, 1958.

By the beginning of 1958, Berkeley had been elected as the Temporary Chair of the Greater Boston Committee for a Sane Nuclear Policy and was working with that group to form a Technical Committee on Ways and Means for a Lasting Peace. He sought to apply scientific principles to further the cause of peace, "in a way as if the committee were a Rand Corporation not for war but for peace."[48] He contacted Norman Cousins, editor of The *Saturday Review* and chairman of the Committee for Sane Nuclear Policy, to enlist his help for "getting more magazines to take a social responsibility" by approaching magazine editors under the aegis of the Technical Committee on Ways and Means to a Lasting Peace.[49] Berkeley continued to be active with the Greater Boston Committee for a Sane Nuclear Policy in the late 1950s, serving on its editorial board and as its assistant chairman. But as he continued to advocate for peace and against war, Berkeley was hounded by accusations that he was a Communist sympathizer.

In a May 30, 1958 letter to Russell Johnson, who also served on the Greater Boston Committee for a Sane Nuclear Policy, Berkeley countered Johnson's impression that he was pro-Russian or anti-United States:

> I do try very hard and very earnestly to escape the limitations of the particular ideas and beliefs that are common around me. I do try to look on the world situation with the great perspective that I gained (1) from my 3-1/2 months in ten countries of Europe in 1934, and (2) from the wide and unorthodox reading and discussing that I have been doing all my life.
>
> Furthermore, I have seen some of my ideas accepted and welcomed by everybody: for example, in 1927 I could see the great interest and importance of symbolic logic and Boolean algebra, and now nearly everybody sees this. In 1940, I could see the great promise of automatic computers (in terms of Stibitz's complex number multiplier and divider at Bell Telephone Laboratories), and now everybody sees this. I fully expect that many of the unpopular ideas that I hold now will be widely accepted in the future. . . .
>
> I really do think that if enough men of good will try hard enough, the United States and Russia will remain at peace, and that peaceful competition during coexistence will enable the better features of both societies to come to the top of the competition."[50]

Even after his experiences with the Navy Review Board hearings, Berkeley continued to advocate for friendship between the U.S. and Soviet Union. He agreed with the ideas

48. Berkeley, E., January 13, 1958.

49. Ibid.

50. Macdonald, N., May 30, 1958.

put forward by President Eisenhower in his 1957 State of the Union address that people of the two countries should find ways to wage peace, and that scientists should be in the forefront of these international collaborations.

In particular, Berkeley encouraged computer people to apply their technical expertise to problems leading to social cooperation rather than war. He worked with the ACM to establish a Committee on Social Responsibilities of Computer Scientists, as it was called in 1959. But Berkeley again met with allegations that he was a Communist, this time from Louis Sutro, an ACM colleague from the MIT Instrumentation Lab. Sutro and Berkeley were friends. They loaned each other books, training materials, and personal items like a ladder for working around their homes. The families visited socially. In October 1959, however, Berkeley was surprised by a letter from Sutro that threatened to end their friendship, as well as their professional association. After sharing a panel on the social responsibility of computer people at an ACM conference at MIT, Sutro wrote to Berkeley, "When you have an audience you cannot help advocating steps that would bring the United States closer to Communism."

Sutro advised, "You can render a service to Americans by sincere advocacy of communism. In their antagonism toward this way of life Americans sometimes distort the image. Being further over on that side you can help them get the facts straight. . . . But to enter a discussion without naming your ultimate goal," he continued, "is to deceive them, I believe." Sutro called for Berkeley to resign from the ACM Committee on Social Responsibilities of Computer Scientists unless he agreed to be identified as "an advocate of communism."[51]

Berkeley responded and sent copies of Sutro's letter and his response to the other members of the ACM committee, Arvid Jacobson and Melvin Shader. Berkeley said to Sutro,

> I am not a communist, and I do not advocate communism. I do think that I agree very basically with these positions:
>
> 1. The capitalist system as we know it is one which is likely to change in the future to a better system, in which there will be much more public ownership of the means of production than exists now.
> 2. The policies of the United States and Russia, in now relying on military methods of defense including hideous nuclear weapons, are dangerous and wicked. These policies are likely to lead to the death of hundreds of millions of people, and are unwise. In my opinion the Russians and the Chinese have no intention

51. Sutro, L., October 28, 1959.

> of allowing a war to start, but intend to defeat us by economic and political activities. . . .

> I could . . . write a long list of the things I dislike about communism, of which a few are: (1) the absence of more than one political party; (2) the deadening influence of Marxism-Leninism (Lysenko for example); (3) the atrocious executions committed by the Russians and the Chinese from time to time, and on a large scale.
>
> But the world is a complicated place, and a simple theory that so-and-so is a communist does not explain it, nor does it explain a person or his views.[52]

Berkeley closed with the hope that he and Sutro could "go back to being friends" as they had been for nearly 10 years. Although Berkeley and Sutro patched up their differences, this was not the last time Berkeley was accused of having Communism sympathies.

Nuclear Disarmament and Communist Infiltration

At the Western Joint Computer Conference in May 1960, discussion of a paper "Learning and Problem-Solving Machines" by H. L. Gelernter characterized the outcomes of new programs for the IBM 704 as being "perceptive" and "adaptive."[53] Computers were no longer simply unintelligent machines; new heuristic programming resulted in machines that showed "ingenuity" and the cleverness of a "high-school student."[54] Some of the best thinkers of the time foresaw a not-too-distant future where humans working with intelligent machines would establish international relations. In 1960, for example, Simon Ramo from the Thompson-Ramo-Wooldridge Corporation (TRW) predicted that the "new man-machine partnership in intellectual activities for the world of the future will determine the relative position of nations more than any other single factor."[55] In partnership with computers, humans would establish relationships with other countries either through war or peace. In 1958, these relationships were established through threats of war or actual wars, increasingly with missiles carrying nuclear warheads and guided by computerized guidance systems that automated the ballistics trajectory charts developed during World War II.

In a January 1958 article in the *New York Herald Tribune*, William H. Pickering (Director of the Jet Propulsion Laboratory at California Institute of Technology) char-

52. Berkeley, E., November 4, 1959.

53. Berkeley, E., August 1960.

54. Gelernter, H. L., 1958.

55. Ramo, S., January 1960, 6.

acterized the threat from these automated missile systems: "[T]he decision to destroy an enemy nation . . . and by inference our own . . . will be made by a radar set, a telephone circuit, an electronic computer. It will be arrived at without the aid of human intelligence. If a human observer cries, 'Stop, let me check the calculations,' he is already too late, his launching site is destroyed and the war is lost."[56] In a 1959 paper, Berkeley's friend Louis Sutro (MIT Instrumentation Lab) described a situation where "there may not be time for the President to respond to a threat to the nation's existence," but that "automatic devices" would respond to a nuclear attack. He called for "emergency simulation" to deliberate and plan these responses in advance of possible attack.[57]

In the late 1950's, the world had experienced the first and second World Wars within 40 years, witnessed the spread of Communism from Eastern Europe to China, and was in the midst of the Korean War. It was not far-fetched to believe that the weapon used to end the war in the Pacific in 1945—the atomic bomb—would be used again before the century was over. The question of how to avoid nuclear war was urgent; many people sought answers. Berkeley insisted that computer people should pursue peace systems as vigorously as they pursued systems of war. He saw a number of avenues open to him: as the secretary of the ACM Committee on the Social Responsibility of Computer Scientists, as the editor of *Computers and Automation*, as one of the first people to write about computers for a popular audience, and as a member of the national board of directors for The Committee for a Sane Nuclear Policy. Berkeley used all the available avenues to urge computer scientists to attend to their social responsibilities.

Berkeley was not alone in his insistence that pursuing peace should be a national concern as important as waging war. By 1958, opinion polls showed that over half of Americans considered radioactive fallout a "real danger" and believed that the United States "should cease [nuclear] testing if all other nations did so."[58] Scientists, politicians, scholars, journalists, and technology developers joined the campaign against nuclear weapons tests. In 1960, Florida congressman Charles E. Bennett introduced House Resolution 9305 to create a National Peace Agency.[59] Its purpose was "to deal

56. Pickering, W. H., February 25, 1958.

57. Berkeley, E., April, 1959.

58. Osgood, K., 2006, 200. Osgood also discusses the U.S. response to protests against nuclear testing: "U.S. propaganda tried to restrain the rising tide of public opinion. The United States adopted an assertive public relations stance stressing that it tested only to maintain 'an atomic shield against aggression."' (201).

59. Full text of the proposed bill was printed in the July, 1960 *Computers and Automation* 9(7), 22–23.

with problems related to achieving peace through arms limitation agreements, to developing international control and inspection systems, to endorse such agreements, and to supplying scientific and technical resources to promote peace by eliminating or reducing the economic causes of war."[60] Former First Lady Eleanor Roosevelt supported this bill in her daily newspaper column "My Day":

> This bill is worthy of study by all those interested in safe disarmament. It stresses the government's interest in "research and development bearing upon the science and technology of nuclear tests monitoring."
>
> Of course, if this can be perfected it will take what risk there is out of a treaty designed to prevent nuclear tests. If we have a device that can detect even underground explosions, then we would be safe in making a treaty.
>
> I believe it would be better to make a treaty and take the present risk, since the risk for continuing the tests is one to the whole human race, and the Soviets, as well as ourselves, are aware of this risk.[61]

In reporting on this bill, the editors of *Science* magazine quoted Representative Bennett describing his bill as "one that would launch studies which would find the mechanisms for peace."[62] Noting that the United States allocated $44 billion to the defense budget and nothing for "meeting the peace needs of our time," the bill proposed establishing a $1 billion budget, placing it on the scale of the National Aeronautics and Space Administration (NASA). The Advisory Committee on Science and Technology of the Democratic Advisory Council warned that "agreements on the limitation of nuclear tests and the production of nuclear weapons are urgent while the 'nuclear club' is still small. . . . Time is running out. It is absolutely vital that we organize our best thinking and processes of government so that out science and technology can be applied with all of is resourcefulness and ingenuity to devising solutions to . . . the maintenance of peace."[63]

But this movement for nuclear disarmament and peace was countered by people who saw the need for a strong reaction to the threat of Communist infiltration, even if this reaction itself threatened civil liberties. On 25 May 1960, Senator Thomas Dodd (D-Connecticut), made the following comments on the floor of the Senate:

60. Roosevelt, E., January 20, 1960.

61. Ibid.

62. Anonymous, February 5, 1960, 340.

63. Ibid.

> Evidence . . . indicates that the Communist Party has made the nuclear test ban movement the chief target of its infiltration operations. . . .
>
> The Committee for a Sane Nuclear Policy is headed by a group of nationally prominent citizens about whose integrity and good faith there is no question. Among them are people like Norman Cousins, of the *Saturday Review*, Mr. Clarence Pickett of the American Friends Service Committee, . . . They advocate a point of view which some of us consider unrealistic or Utopian, but it is, nevertheless, a significant point of view on an issue of life and death importance. . . .
>
> On May 19th, the Committee for a Sane Nuclear Policy held a rally at Madison Square Garden . . . speakers included Mrs. Eleanor Roosevelt, Mr. Alfred Landon, Mr. Walter Reuther . . . speakers urged that another summit meeting be convened . . . to arrive at an agreement banning nuclear tests.
>
> Because I esteem the sincerity of the original founders of the Committee for a Sane Nuclear Policy . . . it was for me an unpleasant duty to have to notify them that the unpublicized chief organizer of the . . . rally was a veteran member of the Communist Party; that there was also evidence of serious Communist infiltration at chapter level.[64]

After a lengthy recitation of alleged evidence for this Communist infiltration, Dodd advised the Committee for a Sane Nuclear Policy to "purge their ranks ruthlessly" as a protection from further Communist infiltration. In closing, Senator Dodd paid "personal tribute to Mr. Norman Cousins, The Chairman of the Committee for a Sane Nuclear Policy, for the manner in which he has reacted to the revelations of the Subcommittee. Not only did Mr. Cousins act immediately to suspend Mr. [Henry] Abrams, but when he saw me in Washington he asked for the Subcommittee's assistance in ridding the Committee for a Sane Nuclear Policy of whatever Communist infiltration does exist."[65]

Senator Dodd's remarks elicited a heated debate among Committee for a Sane Nuclear Policy (SANE) leadership at national and local levels. National chair Norman Cousins advised the board to implement a strong statement in their bylaws requiring that members of SANE renounce ties to anti-American groups. Berkeley, a member of this national committee, argued against such a move to institute a loyalty oath, stating that people could work together for peace no matter what their other political affiliations might be. His position was supported in a proposal introduced by national

64. Dodd, T. J., May 25, 1960.

65. Ibid.

committee members Clarence Pickett,[66] Stewart Meacham,[67] and Robert Gilmore.[68] SANE board members voted 14-4 against this position for SANE to remain open to all members. Instead, the SANE National Board approved a policy statement that read, "Therefore, members of the Communist Party or individuals who are not free because of party discipline or political allegiance to apply to the actions of the Soviet or Chinese government the same standard by which they challenge others are barred from any voice in deciding the Committee's policies or programs."[69] Berkeley was "appalled" and responded in an emotional letter to Cousins:

> I will answer your question if you ask it to me "It is a matter of common knowledge that I am not a member of the Communist Party, and it is also true that I am not a member of the Communist Party." But it is against my principles to be an informer, and I will not be one . . . To act otherwise seems to be dishonorable, and not the action of a gentleman; and the first Edmund Berkeley came to this country in 1660 I think, and another ancestor of mine fought in the Revolution, and another fought in the Confederate Army, and I was a Lt. Comdr in the Navy in World [War] II, and I will not have anything to do with informing or spying—they are thoroughly shameful activities, repugnant to honorable men. And I am going to stand by those people who work loyally and honorably for the Sane Nuclear Policy movement, so that everybody without regard to their political or nonpolitical coloration may be saved from the radioactive ashheap.
>
> I am sorry that some of the things that you have done make me twinge and recoil, especially those things where it seems to me that you promised unscrupulous

66. *Peace Theology,* December 14, 2009: "Clarence Pickett, who died in 1964, was a giant among the great humanitarians of the 20th century. For many years, Pickett served as the executive secretary of the American Friends Service Committee (AFSC). He oversaw the AFSC's wide-ranging efforts to meet human needs and witness for peace in some of the most turbulent and violent years of recent human history. Pickett and the AFSC received the ultimate accolade when the AFSC was awarded the Nobel Peace Prize in 1947, most especially for their work in saving millions of lives of post-World War II displaced persons."

67. Anonymous, April 2, 1985: "In the mid-1960's, Mr. Meacham . . . served as peace education secretary of the American Friends Service Committee, a Quaker organization. In 1968 Mr. Meacham and two other antiwar leaders went to Hanoi and helped arrange the release of three American airmen imprisoned in North Vietnam. Later, as co-chairman of the New Mobilization Committee to End the War in Vietnam, Mr. Meacham in 1969 helped plan a two-day protest in Washington, in which 40,000 people marched from Arlington Cemetery to the Capitol."

68. Cook, J., June 15, 1988: "Robert Wallace Gilmore, an organizer of peace and civil rights groups and the founder of an agency devoted to improving education worldwide. . . . From the late 1940's through the 1960's, Dr. Gilmore, a Quaker, was active in peace and civil rights groups. He was an organizer of the Congress on Racial Equality, known as CORE, and took part in civil rights programs sponsored by the Quakers. He was also an organizer of the National Committee for a Sane Nuclear Policy, known as SANE, the Committee for Non-Violent Action, the International Confederation for

> and paranoid enemies of the Sane Nuclear Policy movement things they should not have—but just the same I thank you from the bottom of my heart for all the fine things and noble things you have done for the Sane Nuclear Policy movement.[70]

In response, Cousins quickly sent Berkeley a cordial explanation of his position *vis a vis* the Senate Internal Security Committee and Senator Dodd's actions. Cousins began with points on which he and Berkeley agreed, such as the importance of peace and the need for an organization to work for nuclear disarmament. But, he asked, "Is such an organization likely to be effective if it joins with Communists or if it permits Communists to join with it? . . . I think that the easiest way to lose any rapport with the American people is to speak to them through an organization that is spotty on this question."[71] Cousins continued, revealing the anti-Communist climate of the times: "I would say, perhaps pompously, that I could not take a liberal position without opposing communism. I am not unaware of the difficulties involved in this position or the ease with which uninformed, blind opposition to Communists can turn into uninformed, blind opposition against all dissenter groups. Indeed, in the past few weeks I have felt—and so has the [*Saturday Review*] magazine—severe attacks by those who contend we are fronting for Communists and their objectives."[72]

Finally, Cousins explained that he tried to prevent Senator Dodd's public denunciation of SANE's membership and activities: "I worked as hard as I could to keep Senator Dodd from attacking our Committee. . . . I asked that, before he made any statement based on a single case, he accept our offer to demonstrate the untruth of the implications of his charges. . . . The statement he eventually made is not a McCarthy statement and we would be making a grave mistake to react with anti-McCarthy conditioned reflexes."[73]

Berkeley, in an equally cordial response to Cousins a few days later, insisted that he was "convinced we must not cooperate with people hostile to us. We must not turn over to them records of our people—except in cases where information is public, or has been released by the persons concerned. We must not be informers."[74]

Berkeley met with Cousins in June 1960 to discuss this situation with SANE while Berkeley was in New York. In a follow-up letter, Berkeley concluded:

Peace and Disarmament and the Committee for a Political Settlement in Vietnam. . . . From 1942 to 1946 he served in the Army Air Corps."

69. Berkeley, E., July 13, 1960.

70. Berkeley, E., May 27, 1960.

71. Cousins, N., June 1, 1960.

72. Ibid.

73. Ibid.

74. Berkeley, E., June 4, 1960.

> It seems to me we have to find a place in the Sane movement for the people who are going to be pushed out by the actions of the National Committee. . . . The Dodd strategy is becoming quite clear, in the [Linus] Pauling[75] case. (1) Subpoena someone on 24 hours notice. (2) Ask him to inform about other people. (3) Send him to jail if he does not inform. (4) If he does inform, call up all the people whom he names, and put them through the same ordeal; or else go over the list of names which he furnishes, and say such and such a percent are communist. Consequently, it is not necessary for members of Sane to prove whether or not they are communist; all that is necessary is to see if they inform on other people or not. If they inform, they are not communist. If they do not inform, send them to jail.[76]

On June 21, the Greater Boston Committee for a Sane Nuclear Policy met to vote on a membership policy statement. This local group was not officially chartered with the National Committee of Sane Nuclear Policy and could decide not to require an anti-Communist loyalty oath of their members. Berkeley was on the Executive Committee of this local Boston group, which approved their own membership policy statement in opposition to the SANE National Committee's policy: "We . . . will not tolerate influence in setting our policy from people following a totalitarian philosophy. We . . . will not hesitate to criticize any person, group, or nation whose actions or policies bring the threat of nuclear war closer. We . . . will continue to welcome all who show by their actions that they are able to make positive contributions to our constructive program and who are objective enough to criticize any person, group, or power that departs from a sane nuclear policy."[77]

On June 27, Robert Gilmore sent a letter to the members of the National Committee for a Sane Nuclear Policy, including Berkeley, "reluctantly" offering his resignation from that board: "I feel . . . that we have made a profound moral and political mistake and that I am so completely out of sympathy with this policy that I should be useless to you in attempting to execute it."[78] In explaining his decision, Gilmore argued that SANE could have responded differently to Senator Dodd's "attack with a ringing challenge to the cold war stratagem of discredit and divide, with a clear affirmation of the right of everyone to debate and dissent—an answer that would have made a significant contribution to the new climate in this nation. The fact that SANE turned

75. See "Testimony of Dr. Linus Pauling, Hearing Before the Subcommittee to Investigate the Administration of the Internal Security Act and Other Internal Security Laws, June 21, 1960" for a transcript of this hearing. For newspaper coverage of the hearing, see "Reluctant Pauling Gets Ultimatum on Petition," June 22, 1960 from the Oregon State University Library, at http://scarc.library.oregonstate.edu/coll/pauling/peace/newsclips/bio2.021.12.html

76. Berkeley, E., June 22, 1960.

77. Berkeley, E., July 13, 1960.

78. Ibid.

down this opportunity is, to my mind, a great tragedy." Instead, Gilmore alleged, SANE's actions strengthened antisocial relationships among people that contributed to war and destruction:

> SANE should recognize another cause which contributes to the possibility of mass annihilation, a cause which is in fact the *sine qua non* of war: this is the condition under which one man, or a group of men, regards another man, or group of men, not as fellow human beings but as alien creatures who may be ruthlessly wiped out with justification. This condition, without which war could not take place, is epidemic in the world today. It spreads every time one man looks at another man and sees an alien creature (whom he may label "black," "white," or "Communist"). If SANE contributes to the spread of this disease within its own ranks, it contributes just as surely to the human condition leading toward the destruction it was formed to battle against."[79]

At the end of June, Cousins wrote Berkeley a lengthy letter restating his position regarding SANE, Communism, and Senator Dodd's allegations, sending copies of the letter to members of SANE's National Committee and heads of local chapters.[80] He felt the need to clarify his position in response to actions that Berkeley had taken to contact members of SANE's national committee to advocate for his position against ousting Communists from the organization. Cousins wrote that he learned about Berkeley's actions, which he felt undermined their personal discussions on this issue, with "astonishment and distress."[81] Cousins' detailed explanation of the effects of Communist allegations within SANE's organization provided insight into the effects of international politics on personal lives. His letter did not speak of Berkeley directly, but it was addressed to Berkeley, who was again caught up in questions of national security, loyalty, and social activism. Cousins explained the activities that prompted Senator Dodd's investigation, in particular the case of Henry Abrams,[82] an ophthalmologist in Princeton, New Jersey who counted Albert Einstein among his patients. Cousins wrote,

79. Ibid.

80. Cousins, N., August 5, 1960.

81. Cousins, N., June 30, 1960.

82. Anonymous, February 1, 2009: "Henry Abrams (1911–2009) served as an eye surgeon in World War II in the Public Health Service, attached to the Coast Guard with duty in Greenland and the Philippines. Dr. Abrams was a founder and president of the Princeton Jewish Center, former president of the N.J. Academy of Ophthalmology and Otolaryngology, and chairman of Israel Bonds campaign. He was a volunteer eye surgeon to the Israel Army Medical Corps during and following the 1967 Six-Day War and the Yom Kippur War, in 1973. For his service, Hadassah awarded him the Myrtle Wreath and the Israel Bonds Organization conferred the Jerusalem Award. He was a fellow of the Philadelphia College of Physicians. Professor Albert Einstein was godfather to Dr. Abrams' oldest son Mark."

> Six months ago, Norman Thomas[83] warned the Executive Board that unless it faced up to the Communist issue, this organization placed itself in dual jeopardy. On one hand, there was the danger that increasing Communist activity on the local level would compromise or undermine the organization. On the other hand, there was the danger that our inability or unwillingness to recognize the problem would increase the likelihood of official attack . . .
>
> I offered to put everything I had into the defense of Henry Abrams. . . . All I asked was his assurance that the charges were untrue. . . . When he declined to give this assurance, I tried to point out the harm that could result to the organization and to many individual members. . . . [S]ome of our most valuable members enjoyed national prominence in the entertainment field. They could be cut down in no time at all as the result of a public impression that they were part of a group that was either dominated by or that acted in cooperation with Communist elements. . . . Henry Abrams declined to submit his resignation. I thereupon suspended him on my own authority . . . [84]

Cousins stated that he had met with Senator Dodd, and was assured that "he did not question the right of our organization to champion a controversial point of view, even though he happened to disagree with it." Cousins "tried to convince Senator Dodd of the injustice" of his accusations against SANE. "If the organization itself were seriously infiltrated," Cousins conceded, "that would be something else."[85]

Turning to the case of Linus Pauling, Cousins wrote that the Senate Internal Security Committee summoned Pauling, "who did not hesitate to declare under oath that he was not and had never been a member of the Communist Party. He answered the Committee's questions fully, refusing only when he was asked to identify other persons who had helped him with his petition [calling for a nuclear test ban]. In this case, Dr. Pauling is completely correct."[86] At the committee hearing, Pauling's statement echoed Berkeley's remarks years earlier at his Naval Security Panel hearing: "My conscience will not allow me to protect myself by sacrificing these idealistic young people. I am not going to do it!"[87] Two years later, Pauling received the Nobel Peace Prize "for his work since 1946 'not only against the testing of nuclear weapons, not

83. Norman Mattoon Thomas (1884–1968) was an American Presbyterian minister, a pacifist, and six-time presidential candidate for the Socialist Party of America.

84. Cousins, N., June 30, 1960.

85. Ibid.

86. Ibid.

87. Severo, R., August 21, 1994.

only against the spread of these armaments, not only against their very use, but against all warfare as a means of solving international conflicts."'[88]

Cousins concluded his letter to Berkeley by affirming his belief that SANE could continue as an effective social action group, so long as it had a "policy that membership in the Communist Party is incompatible with membership in SANE."[89] Members of SANE should "exercise intelligent vigilance in terms of what people do. . . . And if there is a serious question, especially about individuals who are in a position of prominence locally, then the matter should be referred immediately . . . to the Executive Director at the National office."[90]

Berkeley responded to Cousins in a July 5th letter, in which he noted that a rift was developing between people supporting the anti-Communist policy endorsed by SANE's National Committee. Local SANE committees were discussing "the mistake which the National Committee is making, in developing an implementation which plays right into the hands of the Dodd committee."[91] The National Committee persisted in its stand, however, and at a November meeting asked Berkeley for his resignation. In a letter to Cousins after he resigned, Berkeley insisted that it was "very important . . . to create 'a place to go' for all the wonderful people that SANE can no longer keep, or that SANE by its May 26 policy and its implementation, will not be able to take in. For it is a fact that there are people not Communists who cannot accept the policy and implementation, and there are people of dishonor to whom lip-service to the policy and its implementation would be no difficulty."[92] Subsequently, the Boston SANE group decided to affiliate with the national organization and accept their bylaws, so Berkeley resigned from that group as well.[93]

Berkeley had taken a stand for his principles of inclusion and peace. He lost the battle with SANE, but went on to form the Boston Committee for Disarmament and Peace, and chaired its Temporary Committee on South East Asia. His focus was increasingly on stopping what he considered to be an immoral war in Vietnam. Linus Pauling was one of Berkeley's supporters in this new Committee and his association with Pauling guaranteed that the FBI would continue to monitor Berkeley's anti-war activities through the 1960s.

88. Ibid.

89. Cousins, N., June 30, 1960.

90. Ibid.

91. Berkeley, E., July 5, 1960.

92. Berkeley, E., November 24, 1960.

93. Berkeley, E., March 15, 1961.

Throughout these disagreements about establishing procedures to display national loyalty, Berkeley steadfastly expressed his concern about a growing military establishment that pushed the world closer to nuclear annihilation. In 1958, three years before President Eisenhower warned of the "grave implications" that the newly established "military-industrial complex" posed for the "disastrous rise of misplaced power,"[94] Berkeley warned that the "armaments industry" "consumes and does not produce. . . . A sufficiently severe war scare makes a scarcity of weapons, produces many jobs, cuts down unemployment, makes prosperity."[95] In other words, the U.S. economy was artificially inflated by national security threats manufactured by a military-industrial complex. Berkeley relentlessly asked why the economy could not instead be built on industries waging peace. He asked why computer people could not use their expertise to build systems for cooperation instead of guidance systems for ballistic missiles threatening nuclear war. He saw this question as the most important issue facing the world in the Atomic Age:

> [I]t is now true that both the United States and the Soviet Union have enough nuclear explosives to put an end to the life of man on earth. And it is true apparently that in a few more years intercontinental ballistic missiles will be in place here and there around the earth, ready at the touch of an electronic impulse, to destroy millions of human beings . . . With this situation at hand, the securing of peace becomes a most urgent necessity. And not only do we want peace by solid intention and agreement, but we also want peace that is not subject to destruction by mistake of either human beings or electronic impulses.[96]

As weapons of mass destruction were able to be deployed and guided by computerized guidance systems, nuclear annihilation could occur in a few seconds—faster than humans could react in case of a mistake. Everyone involved in developing missile guidance systems to deploy nuclear weapons was implicated in the ethical questions involved with human survival, including the computer developers who worked with weapons manufacturers.

Sharing Information before the Internet

Berkeley became a hub of anti-war information from a wide range of sources, keeping people in contact with one another and making information available for debate. By the end of the 1960s, he had published dozens of articles and editorials on the social responsibility of computer people and peaceful uses of computerized systems in the

94. Eisenhower, D., January 17, 1961.

95. Macdonald, N., May 30, 1958.

96. Ibid.

pages of *Computers and Automation*. But as the war in Vietnam intensified, Berkeley became more convinced that questions of peace would drop off the national agenda. Although the United States and Soviet Union signed a Limited Test Ban Treaty in 1963 to slow the development of nuclear weapons, Argentina, Brazil, India, Israel, Pakistan, Saudi Arabia, and South Africa were close to developing their own nuclear weapons in 1968 when the international Treaty on the Non-Proliferation of Nuclear Weapons opened for signature.[97] 1968 was also the most expensive year of the Vietnam War in terms of U.S. spending ($77.4 billion), and casualties from the U.S. (16,592), South Vietnam (27,915), and North Vietnam (nearly 200,000). Despite international talks to limit production of nuclear weapons, North Vietnamese guerilla war tactics signaled a change in warfare even though U.S. forces responded largely with World War II-era weapons and strategies aided by electronic computing devices and guided missiles.

Around the world, social protests ignited in 1968 against military and political repression. In the U.S., civil rights protests grew violent in the spring after the assassination of Reverend Martin Luther King, Jr. In April, Black Panthers and Oakland police battled with guns in Northern California. In June, Robert Kennedy was assassinated at a hotel in Los Angeles after winning the California primary election to run as the Democratic candidate for President of the United States. News from the Chicago Democratic National Convention in August shocked television viewers with images of Chicago police officers bludgeoning young antiwar demonstrators in the night outside the convention hall. Haynes Johnson, who covered the convention for NBC's "Today" show, remembered those events some 40 years later: "The 1968 Chicago convention became a lacerating event, a distillation of a year of heartbreak, assassinations, riots, and a breakdown in law and order that made it seem as if the country were coming apart. In its psychic impact, and its long-term political consequences, it eclipsed any other such convention in American history, destroying faith in politicians, in the political system, in the country and it its institutions."[98]

On May 1, 1970, antiwar protests broke out on campuses across the country after U.S troops moved into Cambodia. At Kent State University, antiwar rallies became confrontations between students and police in the town surrounding the university. On May 4th, National Guard troops were ordered onto the campus of Kent State University to disperse a crowd of demonstrators. Guardsmen fired over 60 shots into the crowd, nine students were wounded and four students were killed. This was "the day when the Vietnam War came home to America."[99] It was a "great American

97. Office of the Historian, 1968.

98. Johnson, H., August 2008.

99. Lewis, J. M. & Hensley, T. R., Summer 1998.

tragedy"[100] that for many people symbolized a loss of hope and faith in the American political system.

In the midst of this national turmoil, Berkeley published an editorial in the February 1970 *Computers and Automation* warning that "The House is on Fire." He warned of the threat that computer professionals posed to global survival when their attitude was "I'm just doing my job" and they worked on any project their employer put before them: "Scientifically it is easy to show that . . . [this] attitude . . . will lead to the destruction and extinction of the human race, just as the dinosaurs became extinct."[101] A more socially responsible attitude for computer professionals would consider their work as building bridges to connect people: "[T]hey will refuse to work on calculations for the dissemination of nerve gases, or . . . targeting nuclear weapons, or . . . for the design of crematoria for thousands of human corpses. They see a responsibility greater than that to their government or employer—they see a primary responsibility to their fellowman."[102] Berkeley urged computer scientists to consider themselves human beings first, and computer professional second, when they made choices of how to apply their expertise. If they followed Berkeley's advice, computer scientists would believe that the "fact that thousands of human beings have been killed by both sides in the Viet Nam conflict requires people everywhere to seek withdrawal of foreign armed forces from that unhappy civil war."[103] If they followed Berkeley's advice, computer scientists would refuse to work on military projects and focus instead on projects that worked to ensure human survival.

In this 1970 editorial, Berkeley argued that "the earth as an environment for human beings had changed enormously in the last 25 years and is deteriorating fairly rapidly." Before World War II, a person could escape from danger by getting far enough away from it. People could survive by moving to a new place. But Berkeley warned that running away from danger was no longer possible "because of interlocking planet-wide systems of consequences, the environment of the earth is no longer safe for human beings."[104] He saw three threats as being especially acute: "Large-scale nuclear war (and its radioactivity) . . . The explosive increase in the number of human beings alive . . . Pollution of the air, the water, and the land by man's activities."[105]

100. Ibid.

101. Berkeley, E., February 1960.

102. Ibid.

103. Ibid.

104. Ibid.

105. Ibid.

Berkeley ended his editorial by quoting from George Wald, 1967 Nobel Prize winning biochemist and social activist, whose talk "A Generation in Search of a Future" had electrified listeners at an MIT teach-in on March 4, 1969. Berkeley echoed Wald's concern with the future being left to the next generation of human beings instead of facing the current generation's social responsibility for the consequences of waging wars. At the MIT teach-in, Wald called the Vietnam War a war crime that constituted "the most shameful episode in the whole of American history." But he saw a larger problem the state of perpetual war that was now considered normal:

> [B]efore World War II the entire American army . . . numbered 139,000 men . . . Now we have 3.5 million men under arms: about 600,000 in Vietnam, about 300,000 more in "support areas" elsewhere in the Pacific, about 250,000 in Germany. And there are a lot at home. Some months ago we were told that 300,000 National Guardsmen and 200,000 reservists had been specially trained for riot duty in the cities . . . [S]o long as we keep that big army, it will always find things to do.[106]

Berkeley and other antiwar activists shared Wald's concern with the military juggernaut facing the United States and the world. Berkeley's attention was particularly focused on computer scientists' contributions to this merciless force and the effects of their work to create weapons of mass destruction. In the pages of *Computers and Automation*, he provided space for groups such as the Computer Professionals for Peace to publicize their activities. In the March 1970 edition, Edward Elkind[107] urged "all computer professionals to seek employment in projects unrelated to war."[108] Berkeley agreed with Elkind's approach, believing that "The House is on Fire"[109] and humankind's survival was in question. Computer people should wage peace, not war.

106. Wald, G., March 4, 1969.

107. Anonymous, December 1, 2011: "While an 18-year-old freshman at Rensselaer Polytechnic Institute in Troy, N.Y., in 1948 [Elkind] worked to register voters, organize a rally, distribute literature and acted as a poll watcher in the Henry Wallace for President Campaign. Those he met in the campaign influenced him to join the Communist Party, to which he remained loyal for the rest of his life. . . . Because of his science background, Elkind was attracted to the anti-nuclear and peace movements, helping establish the Computer Professionals for Social Responsibility, which is now a global organization. He also worked with SANE for many years, which included participation in marches and electoral campaigns to pressure legislators to establish a moratorium on nuclear bomb testing in the atmosphere and arms proliferation."

108. Elkind, E., March 1970.

109. Berkeley, E., February 1960.

7

A Denunciation of Killing Devices, 1952–1972

In the closed world of the Cold War, all military conflict took place beneath the black shadow of nuclear arms. It was war in a military world where mutual and total annihilation, even the end of all human life, was the overarching possibility within which all other conflicts were articulated. . . . Against the contradictions and the terror of nuclear arms, war itself became as much an imaginary field as a practical reality.

—Paul N. Edwards

In August 1972, Berkeley had been invited to present a keynote talk at a dinner celebrating the 25th anniversary of the founding of the Association for Computing Machinery. In the midst of his talk at the Boston Sheraton Hotel, Berkeley looked up to see a stream of computer people walking out of the room. This wasn't unexpected. He was accustomed to being unpopular for the things he said. But this time Berkeley's long-time colleague Grace Hopper was leading the walk-out. Navy Commander Hopper was the director of the Navy Programming Languages Group; many of the people walking out of the ballroom were her military colleagues.

Berkeley continued speaking. He told the audience that anyone who was working to further military uses of computers should quit their jobs. He talked about the social responsibilities of computer people and his belief that computers should be used for peaceful purposes, not war. "He said that it was a 'gross neglect of responsibility' that ACM was not investigating whether computer applications were good or evil and how computers could be used to increase the good of society."[2] After he was through speaking, the evening's toastmaster, Eric Weiss, stood up and proposed a

1. Edwards, P. N., 1996, 14.

2. Weiss, E. A., 1995b, 87.

toast, "Charge your glasses. To Ed Berkeley, founder of ACM!" And the people who had not walked out all drank a toast to Berkeley and his unpopular message.[3]

It was 1972 and TV sets brought the Vietnam War into homes around the United States. Video images of American soldiers carrying stretchers with bloodied comrades onto helicopters hovering in jungle clearings made for contentious conversations around dinner tables. Sounds of thumping helicopter blades, wounded moans and shouted commands from traumatized soldiers half a world away joined family discussions of current events. It was a time of disagreement over the morality of the decades-long war being waged halfway around the world.

More and more Americans knew these soldiers personally, as troop numbers in Vietnam increased to over 549,000 in 1968 and 1969. As bombing intensified in Southeast Asia, General Westmoreland warned President Johnson that "the war could go on indefinitely."[4] U.S. draft boards called up young men who waited to learn their fates. Hushed discussions among friends shared information about fleeing to Canada for asylum—just in case. An estimated 60,000 young men burned their draft cards and crossed that border.[5]

By 1972, U.S. troop numbers in Vietnam had fallen to 24,000 but the fighting had degenerated into chaos. Death tolls in this ongoing conflict included nearly 58,000 U.S. troops killed or missing in action, combined with over 1.3 million Vietnamese deaths.[6] In an end-of-year wrap-up, the United Press International reported that in 1972, "American deaths were only about 300. South Vietnamese troops suffered by their own official count more than 25,000 deaths. Communists killed total 140,000. Civilian dead is, of course, unknown."[7] Sickened by images of carnage, frightened by the prospect of losing loved ones to death in a jungle or to exile in another country, shamed that the U.S. was using technologies of modern warfare to fight civilians and North Vietnamese in black pajamas, increasing numbers of citizens began to question why the U.S. had taken on this war effort in Vietnam. Thousands of draft-age men became conscientious objectors. Hundreds of thousands of people demonstrated against the Vietnam War. Berkeley was one of those protestors; he been active in anti-war efforts since 1958.

On that August evening at the Sheraton Hotel in 1972, Berkeley had been invited to address the Association for Computing Machinery (ACM) Founder's Dinner. It was

3. Weiss, E. A., 2005.

4. Gibbons, W. C., 1995, 611.

5. Gray, J., July 6, 2004.

6. Vietnamgear.com, 2005.

7. United Press International, 1972.

the Silver Anniversary Evening of the annual conference; he and Franz Alt were being honored as the association's founders. Alt's topic was "Reflections" and Berkeley was to address the future with the topic of "Horizons." After Alt's speech, Berkeley was "formally identified with some pomp and ceremony . . . as [the ACM's] singular founder."[8] He rose to give his keynote remarks. Up to this point, no one had seen his speech, so the audience undoubtedly expected to hear a standard banquet talk celebrating the organization's bright future. ACM President Walter Carlson, though, knew that Berkeley could be unpredictable:

> The organizers of that special session were well aware of Ed's outspoken nature and of the many views he had espoused, especially in the [*Computers and Automation*] periodical he was publishing. In fact, some members voiced their objections to the conference committee and urged that he be kept off the program.
>
> So everyone waited expectantly to see what Ed was going to say. Predictably, he picked up an armload of verbal baseball bats and laid about with great vigor. He hardly missed any of his favorite targets, and no one was surprised to see who the people were that arose in the middle of his talk and left the room.[9]

In his keynote remarks, Berkeley returned to his abiding concern with social justice and activism, saying that it was a "gross neglect of responsibility" that the ACM did not have committees investigating whether computer applications were good or evil.[10] Eric A. Weiss, who was the evening's toastmaster, described what happened next:

> He encouraged data-processing professionals to use "social enterprise" to head off his prediction that mankind would be extinct in 500 years. He said that use of nuclear weapons and irreversible environmental changes, such as an increasing amount of carbon dioxide in the atmosphere, made the situation "too hard to analyze." His ferocity increased as he predicted that vested interests of large corporations would "checkmate" any possible solutions, and he called for the formation of an "Association for the Prevention of Doomsday." He said that the use of computers in the Vietnam War made him "ashamed of belonging to the computer field."[11]

In less than seven minutes, Berkeley called out people in the ACM who worked at companies making bombs to wage what he considered to be an unjust war. He condemned everyone in the room who was employed at any company making weapons to

8. Weiss, E. A., 2005.

9. Adams, J., 1988.

10. Adams, J., 1988; Anonymous, August 23, 1972; Anonymous, August 23, 1982.

11. Weiss, E. A., 2005.

kill people in Vietnam. Berkeley's "audience became increasingly restive as his condemnations became specific, and when he finally criticized Honeywell, by name, for its 'atrocity engineering' in designing antipersonnel bombs, several prominent members followed Grace Murray Hopper as she ostentatiously stood up and walked out while he was speaking."[12]

After Berkeley finished his talk, toastmaster Weiss tried to restore order, but the event was in disarray. At the end of the dinner, Weiss overheard Berkeley comment to his wife, "These people hold two opposing ideas in their minds at the same time." They worked on lethal weapons of war, believing they advanced the computing profession. These two ideas were incompatible in Berkeley's mind.[13]

Berkeley's speech did not go unnoticed among his colleagues. *Computerworld* summarized it in a front page article on August 23, 1972, which they reprinted ten years later.[14] Eric Weiss described Berkeley's speech in a biographical sketch:

> In 1972 ACM honored Berkeley as its singular founder at its 25th anniversary dinner. His acceptance speech was a direct denunciation of those in computing who worked on the killing devices used in the Vietnam War, or computing companies that made such horrors, and of ACM for ignoring this immorality. He said that it was a "gross neglect of responsibility" that ACM was not investigating whether computer applications were good or evil and how computers could be used to increase the good of society. Several prominent ACM members, employees of the firms and government military agencies that Berkeley had pointed to, ostentatiously walked out of the banquet room while he was speaking. The leaders of ACM were clearly embarrassed by their honoree, and the ACM never publicly referred to his speech in any way.[15]

Berkeley made his point at the ACM Silver Anniversary dinner, but over his career he paid a high price for his principled stand.

Using Computers for Peaceful Purposes

For most of his adult life, Berkeley had worked for the cause of world peace and on that evening in 1972 the world had come to his doorstep. He believed that if people worked together, they could make their voices heard. But Berkeley found that rallying people to work together for the cause of peace and disarmament often resulted in political scrutiny. His work with the Committee for a SANE Nuclear Policy, the Boston

12. Ibid.

13. Weiss, E. A., February 19, 2011.

14. Anonymous, August 23, 1972.

15. Weiss, E. A., 1995b, 87.

Committee for Disarmament and Peace, the American Friends Service Committee, and other peace groups convinced him that even if a message was unpopular, the American people had a right to voice their opinions. In his work with computers, Berkeley raised questions about how these machines were implicated in war and how they could be used instead to promote peace.

Berkeley understood the importance of high-speed, large-scale computing capacity for addressing strategic and tactical wartime needs. He had worked in Howard Aiken's Harvard Lab during WWII to develop the Mark II computer for Navy operations. Yet after the U.S. dropped atomic bombs on Japan and the war ended, Berkeley chose a pacifist's path in search of peaceful uses of computers. In a 1952 article on "Machine 'Intelligence"' in *Astounding Science Fiction*, he made his view clear: "An automatic computing machine which has developed a wonderful facility in . . . [the meaning of words] is the military deciphering machine, of which persons like myself, who do not wish to be contaminated with classified information, know very little."[16]

Rather than primarily considering computers as control mechanisms for weapons and war, Berkeley chose to focus on computers as aids to human decision-making. As early as 1958, Berkeley published editorials on this topic in his monthly magazine *Computers and Automation*. In one editorial, "Cooperation in Horror," he called for a general discussion of "social responsibilities of computer scientists and engineers"[17] as part of professional discussions in this developing field. In a January 1958 editorial statement written under his pseudonym Neil Macdonald, Berkeley posed these questions for discussion in the pages of *Computers and Automation*:

> Are computers and automation a curse or a blessing? Are hydrogen bombs, atomic bombs, intercontinental ballistic missiles, and the rest of the tribe (with their computing brains), a curse or a blessing?
>
> Have Americans lost "face" from the sputniks' appearance? Are Americans going into a mood that regards all scientific endeavor as a race to be won or lost against a potential enemy? What is the social responsibility of scientists for the scientific developments which they produce?[18]

Berkeley wanted to provide a public forum in *Computers and Automation* for a robust discussion encouraging computer professionals to examine the social implications of their work. A sizeable number of people responded to this call for an expanded discussion, but about half of them did not agree that this was their concern. Writing

16. Berkeley, E., January, 1952. Also mentioned in Weiss, E. A., 1995b.

17. Berkeley, E., February, 1958.

18. Macdonald, N., January 1958a.

as Neil Macdonald in the May 1958 issue, Berkeley responded to these objections by presenting a parable likening the computer scientist to a locksmith:

> Once there was a man who was in the business of making locks and keys, and who was very skillful. One day a stranger walked into his shop and said to him "I want you to make a key which will open a certain safe." The locksmith said to him "Whose is the safe?" The stranger said "Never you mind whose is the safe. I will pay you handsomely for the key. I'll blindfold you, and take you to the place where the safe is. You can have all the tools you want—I'll pay for them—and you make me a key. . . . Think it over, I'll be back tomorrow."
>
> So the locksmith wondered about the remark "Never you mind," and the blindfolding, and the secrecy; but he knew it was hard enough to earn a living; and the promises of the stranger sounded attractive and exciting. So he said to himself "Well, that fellow would just get another locksmith if I did not go," and so he decided to go. And the next morning the stranger came for him, and he allowed himself to be blindfolded and went.
>
> For several years the locksmith tried to open the safe, and then at last he succeeded. But the stranger did not allow him to look inside; all the locksmith saw was the door swing open. The stranger then said to him, "Here is your pay—now go away—and remember not to talk about this—or you will get into a lot of trouble."
>
> After a few more weeks, the locksmith read in the newspaper that what the stranger had taken out of the safe was a supremely intelligent directing mechanism for flying weapons, from the size of a wasp to the size of an eagle, which would enable him to pinpoint and exterminate any person, any community, any town, any city in the whole world. And he read the stranger's declaration that henceforth the world was to do exactly what he commanded, and that any opposition to his commands or dictates would be precisely and completely destroyed.[19]

Berkeley presented three questions about the locksmith's decision in this parable: Was the stranger a criminal? Could the locksmith have recognized the stranger as a criminal? Did the locksmith do what was right?

He answered the first question by pointing to the devastating wars of the first half of the 20th century: "We know with sadness the many points where [the parable] agrees with the facts of past and current history, and predictions of the future."[20] As to whether the locksmith should have recognized the stranger as a criminal, Berkeley appealed to the Nuremberg trial after World War II to argue that exposure and conviction of Nazi activities should provide a model for condemning similar behaviors. Quoting the military tribunal, Berkeley found that the stranger was a criminal because

19. Macdonald, N., January 1958b, 22–29.

20. Ibid.

he consolidated power by employing technology developers, but not disclosing how he would use the technologies they developed: "War is essentially an evil thing. Its consequences are not confined to belligerent States alone, but affect the whole world. To initiate a war of aggression, therefore, is not only an international crime; it is the supreme international crime different only from other war crimes in that it contains within itself the accumulated evil of the whole."[21]

By pointing to the Nuremburg trial, Berkeley's parable implied that the danger of the Cold War between the United States and Soviet Union could be as dangerous as the Nazi threat that began in Germany with secrecy and suppression of civil liberties in 1933. Berkeley's quote came from the 1954 book *Tyranny on Trial: The Evidence at Nuremberg* by Whitney R. Harris, who was a trial counsel for Nuremburg prosecutor Justice Robert H. Jackson. Berkeley described this book as an "extraordinary, breathtaking, and bloodcurdling story, worth careful reading today to show how and in what way the German state under Hitler planned, prepared, and carried out aggressive war under a thick screen of lies."[22] Berkeley feared that the Cold War "screen of lies" would result in another world war, which would involve nuclear weapons more lethal than those in the last war.

In his detailed account of the Nazi regime, Harris carefully described how Hitler began his campaign of lies to consolidate power as soon as he was elected as Chancellor of the German Reich in January 1933. By ruthlessly seeking the "elimination of all political enemies," the "spirit of democratic resistance was broken and the natural idealism and aspirations of the people were corrupted and abused."[23] In the years after his Navy Review Board security hearings, Berkeley's own natural idealism had been abused in an effort to eliminate Communist enemies within the United States.

At the end of his book, Harris put the wars of the first half of the 20th century into a historical context: "

> The first two thousand years of Christian civilization have constituted an Age of War. War has been a tolerated, even an accepted, method of adjusting differences among nations. . . . There is no greater challenge to modern man than to find that cure and to bring humanity into the Age of Peace. . . . In the first few years of the thermonuclear age there has been placed in the hands of men a new power potential capable of such destructiveness as to threaten the users of the power as well as the intended victims. War has always been homicidal; now it has become suicidal.[24]

21. Ibid.

22. Ibid.

23. Harris, W. R., 1954, 44.

24. Ibid., 514.

In his *Computers and Automation* editorial, Berkeley argued that, like the locksmith in his parable, people who had the know-how to develop destructive weapons had a social responsibility to refuse those assignments in order to lead humankind into peace rather than war. Berkeley concluded that the stranger's criminality in his parable was equal to that of a war criminal. In other words, when organizations asked computer developers to create lethal weapons, they acted in a criminal manner; so did individuals who carried out those orders.

Berkeley reasoned that the answer to his question meant that, under long-established law, the locksmith/computer developer had the responsibility to determine whether the stranger/weapons manufacturer was a criminal before agreeing to work for him: "[T]here is no doubt that according to law a locksmith has to satisfy himself that a customer has a bona fide right to the locksmith's help in opening a safe. . . . The more valuable the goods in the safe, the more necessary is the examination of the stranger."[25]

Questioning the social responsibilities of computer people, Berkeley found that in the case of "intercontinental ballistic missiles with hydrogen bomb warheads, three groups of scientists play the role of locksmith: the men who make the nuclear warheads, who are the atomic scientists; the men who make the rocket motors that will propel the missiles; and the men who make the guidance systems, the computer scientists."[26] Berkeley concluded that the "computer scientist, according to law and morality, does not have the right to shut his eyes in regard to the stranger, no more than the locksmith has."[27] He called on his colleagues to shoulder their proper social responsibilities.

Berkeley proposed a concerted, profession-wide effort in this regard: "And if a single computer scientist has trouble thinking all this out logically, then let's have a committee of computer scientists to get together and think this out, and study the social responsibility of computer scientists, with due regard to objective evidence, the toughest of sound logic, and the most practical of common sense."[28]

During 1958, Berkeley continued publishing editorials and articles about the social responsibility of computer people. In September, he sent out a survey to the editors of 92 trade and technical magazines, asking about their editorial policies on coverage of "the social responsibility of scientists in regard to the scientific developments

25. Ibid.
26. Ibid.
27. Ibid.
28. Ibid.

which they produce."[29] In a December news release, Berkeley reported the results of this survey showing that 60 percent of respondents said that "they would on at least some occasions present discussion and argument on the social responsibility of scientists."[30] Berkeley stated, "This unexpected state of affairs seems to be the result of the undeniable fact that science nowadays is penetrating further and further; and so more and more attention must certainly be given to the influence of science in human society."[31]

He repeated his rationale for this broadened scope of discussion among computer scientists: "[W]e have become convinced that the 'ivory-towerness' of 'science for science's sake' or 'technology for technology's sake' must inevitably give way to the goals 'science for humanity's sake' and 'technology in the service of human beings'. Accordingly, the responsibility of scientists is not only to do good work in . . . their employer's and profession's interests but also in the broader field of the interests of their country and the whole world." He concluded that "a scientist or engineer has special knowledge and perhaps special wisdom, and so has a special opportunity to be a help or a hindrance in the social applications of his science, and a special duty to be informed and to spread information."[32] Because computer scientists had specialized knowledge, Berkeley clearly felt that this group had a heightened responsibility to examine their professional motivations. He saw one opportunity to foster this discussion in the pages of *Computers and Automation*. But he didn't stop there.

The Conscience of the Computer Industry

In June 1958, Berkeley spearheaded an effort to create a Committee on the Social Responsibilities of Computer People within the Association for Computing Machinery (ACM). Building on the editorial work he had started in *Computers and Automation*, Berkeley sent a letter to ACM Secretary Jack Moshman asking that a committee be formed to study and report on the following questions.

1. Do computer scientists have a special social responsibility for helping to advance socially desirable applications of computers and helping to present socially undesirable applications of computers—in much the same way as the atomic scientists have recognized that they have a similar special social responsibility (by publishing the Bulletin of the Atomic Scientists and in other ways)? . . .

29. Berkeley, E., December 8, 1958.

30. Ibid.

31. Ibid.

32. Ibid.

2. [C]an the committee study and recommend new applications of computer science that are socially desirable, as for example the use of computer science to help reduce unemployment in the United States during the current recession?[33]

Moshman appointed a committee in September 1958 to discuss these questions with four initial members: Chair Saul Gorn (Computation Laboratory, University of Pennsylvania; member of the ACM Council), Arvid Jacobson (Department of Mathematics, Wayne State University), Mel Shader (IBM, New York City), and Ed Berkeley. In a September 17th letter welcoming members to the Social Responsibilities Committee, Gorn posed questions to be considered at an October 1st meeting. His comments foreshadowed an ongoing tension that finally erupted at the Silver Anniversary dinner fourteen years later. Noting that a "large portion of the ACM membership is involved with government work," he predicted that there "might be quite a difference of opinion as to whether applications considered socially undesirable for private companies should also be so considered for government work. Questions of patriotism, etc. will arise." His own reaction was that "the Association has a purely scientific function and that as scientists we should be concerned with discovering the scope of computer applications regardless of whether others might use such applications for good or ill."[34] In Gorn's opinion, the responsibility for applications of computer developments did not rest with computer scientists.

On September 22nd, Berkeley responded to Gorn in a letter sent to committee members. To Gorn's question about the definition of "socially desirable applications of computers," Berkeley suggested that they are "computer applications which enable more socially useful work to be done with less effort or push forward the frontiers of knowledge or increase the happiness of human beings generally, and which do not lead to widespread death, destruction, unemployment, poverty, famine, and disease, nor the abridgement of the democratic freedoms of individuals."[35] Berkeley added a new topic for the committee to discuss: "Patriotism (Loyalty to One Country) and Internationalism (Loyalty to the United Nations)." Arguing that the principles of international justice established at the Nuremberg trials applied to this question, Berkeley again quoted from Justice Jackson's findings: "In the first few years of the thermonuclear age there has been placed in the hands of men a new power potential capable of such destructiveness as to threaten the users of the power as well as the intended vic-

33. Berkeley, E., June 2, 1958.

34. Gorn, S., September 17, 1958.

35. Berkeley, E., September 22, 1958.

tims. War has always been homicidal; now it is suicidal."[36] Berkeley then concluded in his own words, noting that as an international society, the ACM "needs to bear in mind the interests and responsibilities of the international community of computer people. . . . We know that intercontinental ballistic missiles will not work WITHOUT the contribution of computer scientists to the devices that guide, direct, and navigate them. We must not lose sight of this stubborn fact which affects us."[37]

Jacobson responded to Berkeley's position, weighing in with his belief that "ACM should discuss the problems relating to the kinds of applications made of computers." He stipulated, however, that these efforts should be based on persuasion, education, and general discussion rather than through dictates or coercion. He continued, "[T]he computer is an instrument of general social advance. It is an indispensable tool in practically all areas of research, thus, contributing to the increase in knowledge and technological progress. In this broad sense, the computer constitutes a social good." He then sought to clarify "some confusion relating to the problem of our national defense and patriotism," noting that although "ACM has members in other countries, we must think of it in the context of national rivalries as an agency belonging to our nation. While one may speak of loyalties to UN and so on, one can do so only after one has accepted the loyalties to one's community and to one's country." He concluded that because "this subject is controversial," the Committee on the Social Responsibilities of Computer People "should not directly include it in any resolution."[38]

Committee members gathered in the Computing Laboratory at the University of Pennsylvania on October 1, 1958 with an eight-point agenda. Three of the items considered whether members of the ACM had a social responsibility to be "concerned with discovering the scope of computer applications regardless of whether others may use such applications for good or ill."[39] Another item asked about "Patriotism vs. Internationalism. . . . Should the ACM act as a national United States society, or act as an international society?"[40]

Distributing his six pages of notes after the meeting, Berkeley restated committee members' concerns that computer scientists should not try to be social scientists. They questioned whether it was even possible to make mathematical models in the social sciences. As a student of symbolic logic and former insurance company actuary, Berkeley made mathematical models to solve social problems throughout his career.

36. Ibid.

37. Ibid.

38. Jacobson, A. W., September 30, 1958.

39. Berkeley, E., October 4, 1958.

40. Ibid.

His arguments about the potential for computer scientists to do socially beneficial work was based on his own work with symbolic logic and developing computers as aids to thinking. In his meeting notes, Berkeley connected these ideas to using cybernetics[41] to "re-structure the communication flow in society." For him, this question of addressing social issues was paramount for people who had the knowledge to apply mathematics and logic to ill-structured problems, like computer scientists: "The unified society of mankind will begin to disintegrate if we don't have a means for the proper balance of communication and controls among all the elements of society."[42]

Berkeley then asserted that algorithms could be applied to social science questions by using computers to analyze "any organism in its cybernetic aspect": "An analysis can be done syntactically, by symbol manipulation, without meaning, without semantics . . . . If computers think, then you can ask a computer questions in the sublanguage of the social sciences." He went on to describe what "differentiates a thinking machine from a non-thinking machine is 'loop control' . . . the ability of a machine to modify its own instructions. Or linguistically, the 'command language includes its own syntax.' " He concluded, "[P]eople have to be trained to be non-routine thinkers" and proposed that the ACM convene panel discussions on these topics at their meetings.[43]

Berkeley's line of reasoning was challenged with the assertion that people would make weapons, and other undesirable social tools, with or without computers. Therefore, computer scientists could not prevent socially undesirable outcomes. Berkeley responded that if a question could be solved with or without computer assistance, it was "trivial."[44] In Berkeley's estimation, non-trivial questions involved ill-defined questions with many possible answers. The important point was to devise methods

41. MIT Professor of Mathematics Norbert Wiener had published *The Human Use of Human Beings* in 1950, introducing the idea of cybernetics and information control for human and machine systems. In a January 1947 letter to the editor of *The Atlantic Monthly*, Wiener had set out his opposition to working on weapons development projects: "The practical use of guided missiles can only be to kill foreign civilians indiscriminately, and it furnishes no protection whatsoever to civilians in this country. . . . Their possession can do nothing but endanger us by encouraging the tragic insolence of the military mind. If therefore I do not desire to participate in the bombings or poisoning of defenseless peoples. . . . I just take a serious responsibility as to those to whom I disclose my scientific ideas."

42. Berkeley, E., October 4, 1958.

43. Ibid. John von Neumann's 1956 Silliman Lectures were published posthumously in 1958 under the title *The Computer and the Brain*, in which he compared the workings of the computer and brain in terms of control through language and code. At MIT, Noam Chomsky was working on logical structures of language and had published the book *Syntactic Structures* in 1957.

44. Ibid.

for people using computers to arrive at socially beneficial solutions: "This is the application of a computer where a computer is given a pattern that characterizes a person's needs and interests, and then the machine selects the information to fill these requirements . . . This machine (not yet built) is a 'general information transmitter'; it is also an example of a machine that does not 'compute' as such, but processes data, and can have a serious social implication."[45] Berkeley insisted that his colleagues look beyond the mathematical aspects of computer applications in 1958 and plan for future, more intelligent computers programmed to learn and adapt to responses from humans, systems, the environment, and other machines.

Jacobsen felt that Berkeley's notes over-estimated "the general understanding and acceptance of the problem" regarding computer scientists and their social responsibilities. In response, Jacobsen submitted his own two-page synopsis entitled "Social Responsibilities of Computer Scientists." He proposed a position statement that began, "There is a dynamic interdependence between [the computer scientist's] behavior and society. . . . [C]omputer people must try to be cognizant of the consequences of their behavior. This is especially so since they are the 'components' that most sensitively influence the response of the whole system."[46] Jacobsen asserted that the computer was a "means of control, especially as a system element in self-regulating, self-directing mechanisms" and that it was "an instrument of prediction and conscious control over the course of larger units. Man is thus acquiring the means of directing his own destiny."[47] It was this ability to affect people's destinies that also concerned Berkeley.

Although Berkeley viewed the work of computer scientists as international in scope, Jacobsen did not agree with this perspective: "Relative to whether ACM is a national or international organization, I think that it must first be the former before it can be the latter. The computer and computing people being so intimately related to the well-being and defense of our country, I don't see how else we can view it."[48] In response to the question of who computer people served, Jacobsen came down on the side of national defense.

On October 25th, Saul Gorn, Mel Shader, and Ed Berkeley met in IBM's Madison Avenue offices to discuss Jacobsen's comments. They decided to have Shader draft a 1,000-word statement from the Committee on the Social Responsibility of Computer Scientists to the ACM Council. After defining responsibility as "value systems," the

45. Ibid.

46. Ibid.

47. Ibid.

48. Ibid.

committee argued that an individual's responsibility would vary based on "the kinds of machines and their applications," as well as "computer people's loyalties and value systems (for example, differences arising from the loyalties and value system of a computer salesman)."[49] This situation of varying responsibilities and values would mean that sometimes an individual could experience conflicting responsibilities, in which case that person should not "ignore" or "delegate his responsibility. . . . There is a point of demarcation between what does not matter and what matters a hell of a lot."[50] The committee concluded, "In our report to the Council, we should mention the scientist's credo, 'knowledge for knowledge's sake', and show how easily it comes into conflict with other responsibilities . . . Given human society in our century, and the ethical value system we are using in our century, it is possible to decide definitely some classes of work which can be labeled as obviously socially undesirable, and other classes of work which can be labeled as obviously socially desirable, even if there is a large middle ground which cannot be clearly classified."[51]

On November 19, 1958 the committee's final statement on "The Social Responsibility of Computer People" was submitted to the ACM Council. The five-page report began by restating the committee's charge to "consider 'the social responsibilities of computer people to advance socially desirable applications of computers and to help prevent socially undesirable applications." However, their charge did not include "defining or recommending an official position to be taken by the ACM."' [52]

In the first of three sections of the report, the committee began by stating a case for the special social responsibilities of computer people: "We must look at ourselves (computer people) as being in control of a tremendously powerful tool. . . . Computers are becoming an essential part of the social organism itself, particularly its communication and control system. . . . When one reflects upon the great forces that we computer people are associated with, it is no longer difficult to grasp . . . our heavier-than-average share of responsibility."[53]

The committee argued that computer people cannot ignore, delegate, or neglect their social responsibilities to "benefit or harm society" and that they should consider how their "special capacities can help to advance socially desirable applications of computers and help to prevent socially undesirable applications." Ultimately, computer people could not "avoid deciding between conflicting responsibilities" but

49. Berkeley, E., October 4, 1958.

50. Ibid.

51. Ibid.

52. Gorn, S., Berkeley, E., Shader, M.A., & Jacobson, A. W., November 19, 1958.

53. Ibid.

"must think how to choose."[54] The social responsibility was theirs and could not be delegated or ignored.

The report made the case that computer applications could be considered "desirable" and "undesirable." Examples of desirable applications included "analysis of causes and processes contributing to cancer; analysis of mental and emotional illness; solution of metropolitan traffic problems; mechanical translation of languages to aid in scientific understanding." An undesirable application was cited from a *Computers and Automation* article by Dr. W. J. Pickering, (Head, Jet Propulsion Laboratory, Cal Tech): "This is the prospect we face: the decision to destroy an enemy nation—and by inference our own—will be made by a radar set, a telephone circuit, an electronic computer. It will be arrived at without the aid of human intelligence. If a human observer cries 'stop, let me check the calculations', he is already too late, his launching site is destroyed, and the war is lost."[55] The committee singled out missile guidance systems as an undesirable application of computer technologies. Thus, computer people who were involved in making such systems clearly had an ethical dilemma to resolve; they contributed to work that was harmful to society-at-large.

The committee report ended with four recommendations for action by the ACM Council:

(a) approve releasing and publishing . . . the report of the committee without binding or committing the Association;

(b) . . . encourage the study and discussion in various publication media of topics related to the social responsibilities of computer people;

(c) . . . approve the establishment of forums on this subject at meetings of the Association for Computing Machinery;

(d) . . . continue this committee on a stand-by basis.[56]

On December 11th, Committee Chair Gorn reported the Council's reaction: "The question was tabled at that meeting on the grounds that the council had not had enough time to study it."[57] The report was "bottled up"[58] temporarily, but in March

54. Ibid.

55. Ibid.

56. Ibid.

57. Gorn, S., December 11, 1958.

58. Berkeley, E., December 24, 1958.

1959 the ACM Council accepted the committee's report and continued the committee "'on a stand-by basis.'"[59]

It is not surprising that Berkeley had a guiding hand in crafting the ACM report advocating for socially desirable applications of computers and against socially undesirable ones. This was his life's work. But in the years between this report's approval and the Silver Anniversary dinner fourteen years later, Berkeley's assertions about the social responsibilities of computer people became acute as machines became more intelligent. Even with the help of these intelligent machines, computer people too often chose to serve the military-industrial complex rather than serving humanity—to wage war when they could wage peace.

59. Berkeley, E., 1962, 193.

8 The Remaking of Man, 1973–1987

I think his greatest contribution to the industry was to make the industry itself understandable to the nontechnical person. He always stressed that technology was not for technology's sake and research was not for the sake of research. There had to be a benefit for mankind.

—Judy Callahan

Into the early 1970s, Berkeley continued insisting that computers should be used to wage peace rather than war. On November 15, 1973, Berkeley gave a talk to the faculty and students at St. Bonaventure University in New York entitled "The Remaking of Man—Aspects of Computers and Social Responsibilities." Berkeley argued that "there simply will not be any making or remaking of man at all—unless there is a large increase among men of social responsibility, and in such event computers can be very helpful."[2] He addressed what he found to be the "most important problems in the world," first defining such a problem as one that if not solved, "one of the following things happens: millions of human beings will die; or the environment which human beings need for living will disappear; or the techniques with which human beings can hope perhaps to solve the great problems of human survival cannot be attained."[3] He used the example of nuclear weapons to analyze an "important problem for human beings," stating that the "stockpile of nuclear weapons in the possession of the United States is sufficient to destroy all human life on earth. The same is true of the stockpile of nuclear weapons in the possession of the Soviet Union. France, England, and China have demonstrated nuclear weapons. The "club" of nations that have nuclear weapons is expanding and will expand further." A lethal problem would arise if "another

1. Connolly, J., March 21, 1988.
2. Berkeley, E., November 15, 1973.
3. Ibid.

psychotic dictator like Hitler came to power in any country with nuclear weapons. Then before accepting defeat in a war, he would use them." Instead of preventing this eventuality, Berkeley argued that a "realistic international solution has not even begun. Only an unnegotiated balance of terror exists, which effectively applies only to rational governments."[4] If one country fell under the rule of another Hitler—someone who would stop at nothing to achieve a goal—the survival of everyone on Earth could be jeopardized if that person had access to nuclear weapons. Berkeley found that there were nine "important problems in the world:"

> Modern Technology for Weapons; . . . War-Making Industry: the vested interest in war in almost every country in the world . . . whose profits are linked to war; The Population Explosion—and its handmaidens starvation and famine; The Exhaustion of Resources—and its handmaiden poverty; a condition in which iron, oil, copper, etc. . . . are being exhausted in a century or two by "modern" scientific and technological exploitation; . . . Pollution of the Environment . . . the steady increase of carbon dioxide, lead, and other foreign materials, in the atmosphere of the earth; Waste . . . of time watching TV, waste of food by eating too much, waste of paper distributing advertising messages, . . . all of this constituting fiddling while Rome burns; Deficiencies of Language, Education, and Communication—so that great numbers of human beings cannot exchange ideas with each other, cannot discuss and resolve their differences, cannot easily appreciate the humanity of other human beings; Advertising, Propaganda, and Lies—the information techniques by which vested interests keep their possessions through exerting controls over the information allowed to reach the public; Arresting of the Tendency to Love, and its handmaidens, hatred and genocide."[5]

After listing these problems, Berkeley asked who would solve them? His answer was to call for each person in the audience to take responsibility: "No simple solution like delegation to governments can be expected to work at this time. So the task of solution falls back into the hands of ordinary people everywhere as their social responsibility."[6] The first step in taking this responsibility is to become informed about the important problems. Then "a person needs to develop understanding: a capacity to assess conflicting information and an ability to distinguish the true from the false."[7] But more than being only informed, Berkeley called for the members of his audience to take action: "The reasonable and ethical attitude for every human being

4. Ibid.

5. Ibid.

6. Ibid.

7. Ibid.

is to draw on all the courage and dedication that he possesses or can scrape together and to work and keep on working for:

- lasting world peace with no threat from nuclear weapons;
- the abolition of genocide and the removal of the causes that lead to genocide;
- the pursuit of truth for the benefit of people."[8]

In this large-scale effort, Berkeley argued that computers would be needed to arrive at good solutions. But looking only to computers and expert knowledge would not solve the important problems. "Also needed is the human willingness to try to come to grips with these problems, and human willingness to enroll the governmental power to solve them. . . . For the first time in the history of species on the earth, the currently living members of a species can give very substantial advantage to themselves at the expense of all future unborn generations. It is a very dangerous situation, and a favorable prediction of the outcome seems very unwise."[9] Berkeley doubted whether people had the will to take on their responsibilities and resolve the existential challenges that could only be addressed with the help of modern methods of thinking and decision-making, aided by intelligent machines.

Taking Stock of a Life

In the final years of his life, Berkeley knew he had cancer from which he would not recover. Forty years had passed since those early days of computer development and the uncertainties of a profession that was evolving from mathematics to computer science. In 1986, *Computerworld* marked the 40th anniversary of the Eniac by reprinting an excerpt from *Giant Brains*, along with a retrospective article by Berkeley. He began by remembering that in 1946 he worked at the home office of Prudential Insurance in Newark, New Jersey, where he was "instrumental in the negotiations that led up to the first commercial or business contract for an electronic automatic computer. . . . But there were troubles . . . and IBM gained Prudential as a customer for automatic computing." About those early years, Berkeley said, "We in the computer field . . . were full of excitement and enthusiasm about the prospects of computers as a benefit to humanity. But we did not know, expect or even think much about the rather horrible dangers that have developed in the last 40 years that we can see now."[10]

8. Ibid.

9. Ibid.

10. Berkeley, E., November 3, 1986, 152–153.

Crediting military funding with hastening Eniac's development, Berkeley stated, "The great expansion and evolution of the computer field from 1945 to 1986 would have been far less without military money: the funding from governments and businesses devoted to armaments and preparations for war, the large-scale killing of people." Berkeley warned that "the scale of disaster and destruction that would result from the combination of computers, communications, missiles and nuclear explosives . . . constitutes an appalling and horrible problem." Recalling Nazi atrocities from World War II, Berkeley singled out computer scientists, "along with rocket and nuclear scientists," as being the new "technicians of the 'final solution"' that could potentially kill "more than 5,000 million persons from a nuclear holocaust and the nuclear winter." The causes of this nuclear holocaust would be a "nonrestricted arms race. The interwoven powers of the military/industrial/governmental complex. The mistakes, delusions and hallucinations of government leaders. The immutable laws of probability."[11] Despite this real threat of annihilation, Berkeley ended his article by citing four "reasonable grounds for hope for the survival of humanity:" Leaders "now fear their own nuclear extinction . . . 41 years have passed without war-like use of nuclear weapons. This lack of use may become a habit. . . . [E]ven President Ronald Reagan says occasionally, 'A nuclear war can never be won and must never be fought.' Finally, as more and more of the people of the planet realize the stakes, it is likely they will organize to prevent it."[12] As he had for all his life, Berkeley believed in the power of people working together for the common good, even though his efforts to organize people for those endeavors had largely worked to his professional detriment.

In September 1987, Jim Adams and Anita Cochran visited Berkeley in his home in Newton, Massachusetts to videotape an interview for the upcoming 40th ACM anniversary celebration in Dallas. Berkeley was in poor health, but Adams and Cochran found him in "amazingly good spirits—righteous, stately, and fiercely outspoken on issues. Preparing for his final combat, it was clear that he would not 'Go gentle into that good night."'[13]

During that interview, Berkeley recalled his assignment at the Harvard Computation Lab during World War II: "My function there was to visit for 60 days at a time. . . . [Aiken] said that a certain circuit could not be designed, whereupon I designed it." Berkeley chuckled remembering this incident, then continued, "It was a circuit for four times a number and I took into account the fact that there were some extra contacts on the relays that he had stabilized on—six-fold relays. And I made use of those

11. Ibid.

12. Ibid.

13. Adams, J., 1988.

contacts so that without any extra hardware, more or less I could get four times a digit as well as getting out of the machine one times, two times, and five times. So that only three times a digit had to be produced by a supplementary circuit. That particular trick always delighted me, especially when somebody says you can't do something."[14]

When pressed to talk about the early days of the ACM, Berkeley resisted. He wanted to talk about the future instead of the past:

> Let's think about the importance of questions. This is what I'm interested in. You cannot possibly talk about things that happened a long time ago which are purely historical compared with the importance of questions that exist in the present world. The most important question is whether or not we're going to be alive a few years from now if some nuclear weapons explode. It can easily be predicted that if nuclear weapons start to explode, most of the population of the northern hemisphere will vanish. That is important. . . . And I'm not interested in the history of the ACM compared with the really important problems that lie in front of us in the future: the social responsibility of computer people. The social responsibilities of society have to be handled by persons who understand well what the valuables are.[15]

When Adams asked Berkeley to expand on those issues in a message to ACM members commemorating the 40th anniversary of his founding that association, Berkeley talked about topics that we had addressed for much of his life:

> One problem is population. There's a tremendous argument going on about what to do about population. Reagan, for example, is doing his best to withdraw all support of significant discussion of the population question from any activities supported by the United States. Another question is nuclear weapons. I read today that Iran is engaged in the production of nuclear weapons somewhere up in the northern part of Iran. I don't know if that's true or not. A third question is what are people going to be taught about computers? I've seen statements from the Soviet sources saying that what people need to be taught about computers is a result of what a group of 15 or 20 experts will decide. That is stupid! What has to be taught about computers results from looking at the world and seeing what needs to be taught about computers, the way in which people will think, for example.[16]

Jim Adams characterized Berkeley as "a man of ideas, of dreams, of applied imagination. He was that exceptional blend of aristocratic nobility and deep democratic concern. More to the point, he was an activist." He continued, "During his lifetime he

14. Berkeley, E., 1988.

15. Ibid.

16. Ibid.

championed many causes, but none more fervently than raising our consciousness of the worth of people over technology. Unlike the doleful knight, his aim was true, he did not flail at windmills."[17]

Eric A. Weiss, Berkeley's colleague and toastmaster at the ACM Silver Anniversary dinner, found that "Berkeley's lifetime goal, only partly achieved at his death, was to educate his readers so that they could do as he did: think clearly about important matters, reach wise conclusions, and act bravely in support of their principles. He aspired to be, and was accepted by many as, the conscience of the computer industry because of his devotion to the idea that computers should work for the good of and not the destruction of mankind. He was a teacher."[18]

Walter Carlson, who was ACM president in 1972 when Berkeley gave his inflammatory speech in Boston at the Silver Anniversary dinner, said on the occasion of Berkeley's death: "Ed was always Ed and always his own man. A rare individual."[19]

At the end of his talk at St. Bonaventure University, Berkeley told a story—"The Fly, the Spider, and the Hornet"—about liberation and escape through innovative thinking. Berkeley is the hornet in this fable, the character refuses to take "no" for an answer, will not give up, and ultimately frees himself from stifling conventions. Like the popular Green Hornet of radio, television, and films—a publisher by day and crime fighter by night—Berkeley's hornet prevailed.

> Once a Fly, a Spider, and a Hornet were trapped inside a window screen in an attic. For several hours they walked up and down, left and right, here and there, all over the screen. They could look through the screen at the summer woods, feel the summer breezes, and smell the summer smells; but they could not find any hole to pass through the screen to the woods and fields, so tantalizingly close, yet so far away. Finally, they decided to hold a conference on the problem of getting through the screen.
>
> The fly spoke first and said, "My Colleagues, I have surveyed this screen for many hours without finding any hole. But I cannot believe that there is no hole in this screen. All my experience of the world up to the present time has shown me that there are holes in thickets of twigs, holes in screens of leaves, holes in tangles of grass, holes everywhere. In fact, I have been able to fly over, under, or around every barrier I have ever encountered. Nature does not make thickets, screens, and tangles without holes. Therefore, the principle to be used is perseverance in spite of obstacles. I will fly again and again and again at the screen in hopes of getting through. As the old

17. Adams, J., 1988.

18. Weiss, E. A., 1995b, 87.

19. Adams, J., 1988.

saying goes, 'If at first you don't succeed, try and try again.' I'll never give up; my honor as a Fly is at stake."

The Spider spoke second and said: "My colleagues, I too have surveyed this screen for many hours without finding any hole. I am sorry I have to contradict my honorable Colleague the Fly, but I have come to the conclusion that this screen has no hole. Therefore, the principle to be used is adjustment to changed conditions. So I will plan to spend the rest of my life inside this screen. I shall build my web inside the screen, catch my food, and live out my life in this new way."

The Hornet spoke third, and said, "My Colleagues, I too have persistently surveyed this screen for many hours without finding any hole. But I remember that I flew into this general region without going through that screen. Accordingly, there must be some other way of returning to the woods and the fields. Therefore, the principle to be used is exploration of other alternatives. I shall stop my fruitless search for a hole in this screen, and instead search in other directions and avenues to find other means of escape."

The Fly and the Spider said at once, "Honorable Colleague, please pardon us for saying so, but that is plain silly. Just think how close you are to escaping through the screen—only a few little thin wires between you and freedom."

The Hornet replied, "My friends, those wires may be few, and little, and thin, but nevertheless they are too substantial for me to pass through."

The Fly then said, "Besides, honorable Colleagues, this conference of ours was called on the subject of getting through the screen—and, honorable Colleague, you are off the subject and out of order." The Spider said, "I must agree with the Fly." Thereupon, the Hornet made a motion that the subject of the conference be amended from getting through the screen to escaping to the woods and fields. But he was outvoted 2 to 1.

None of the three would change his views, and the conference soon adjourned.

A day later, the Fly died of exhaustion.

A week later, the Spider, having caught only one moth in his web, died of starvation.

But an hour later, the Hornet exploring under the eaves of the roof between the inclined beams of the attic, found an opening to the outdoors, and flew out, returning to a long life in the woods and fields.[20]

20. Berkeley, E., 1973. 82–84.

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Abbreviations Used for Archival Collections

CBI	Charles Babbage Institute, Center for the History of Information Technology, University of Minnesota, Minneapolis
COH-SI	Computer Oral History Collection, Smithsonian Institution, Archive Center, National Museum of American History, Washington, D.C.
EBP	Edmund Berkeley Papers, Charles Babbage Institute, Center for the History of Information Technology, University of Minnesota, Minneapolis
GHP	Grace Murray Hopper Papers, Smithsonian Institution, Archive Center, National Museum of American History, Washington, D.C.
HUA	Harvard University Archives, Harvard University, Cambridge, Massachusetts
MD-SI	Mathematics Division, Smithsonian Institution, National Museum of American History, Washington, D.C.
SA	Smithsonian Archives, Smithsonian Institution, Washington, D.C.

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