1 Switching on

This is the story of how the world came to inhabit the computer. It is the tale of a major relocation that began seven decades ago, around 1950. For a variety of reasons, efforts to shape a computer-based reality have been ongoing since then – amounting to millions of "man-years," in industry parlance.[1] Today, people refer to the near-total computerization of the world as if it were nothing. Yet the effort to "put the world into computers," as technology historian Michael S. Mahoney wrote, was a long, labor-intensive, and sometimes frustrating undertaking.[2]

How did the world get into the computer? The answer is not to be found in the mix of brilliant pioneering work, entrepreneurial risk taking, coherent genealogies, and exponential growth curves typically trotted out in computer histories. In fact, given the hard work, ambitious project planning, often naïve designs, the anxious wait for program updates, decades of anticipating new hires and new software, as well as the huge effort of developing computerized routines, the story of how digital reality emerged simply cannot begin with the haphazard nature of technological progress or even the machines themselves. Instead of lamenting the victims of computers and blaming the machines for causing "reading and attention disorders, anxiety and dullness, sleep disorders and depression, obesity, propensity to violence, and social decline,"[3] we should focus on what computer developers were thinking and the hopes and dreams of users.

Chance and victimization are poor guides for a good computer history. I would like to take a different approach, which is to explore how people perceived computer-related issues at the time and how they dealt with those issues. I will trace the expectations, mindsets,

and motives of individuals who worked on, directed, or supported this massive shift as technicians, managers, users, entrepreneurs, and civil servants. All were betting on the expanded design possibilities, the potential for analysis, and the acceleration of things in digital space and thus were willing to accept the bumps in the road for themselves and others. But not all of them did it in the same way. Thus, I will tell how the computer has been harnessed for different purposes. What prompted opening up the new space of action, and what challenges did it pose? How did the shift occur from the old registries to the unfamiliar databases, from broadcasting to the World Wide Web, from the floor of the stock exchange to computerized stock trading, and from the roulette tables of casinos to the sophisticated profitability of online games?

The question of how the world got into the computer compels you to think. With a little luck and critical perseverance, you might even come up with an answer. In any case, the sources for this history – the hundreds of thousands of lectures, discussion papers, and articles produced on the subject in the first half-century of computer history – are easily accessible.[4] Time and again these materials sparked new ideas and deliberation on promising courses of action. Essays, announcements, and progress reports furnish information on how the new digital space was to be configured and which rules were developed, tested, and ultimately discarded or implemented. What could reasonably be expected had to be communicated through lectures and articles, strategy papers, announcements, and debates. The record of this work is my inspiration. It tells of successful and failed exchanges in the dynamic project culture that has been part and parcel of the computer world. Contemporaries read these sources as a travel guide. Today, too, they help to navigate the digital space of that time.

The history of computing thus observes observations, and in doing so constitutes a synthesized, concentrated account of a

large number of contemporary accounts. Neither circuit board processors nor characters on long-dead screens, neither data sets nor programs, neither users nor operators can be historically comprehended other than through a critical reading of their commentaries preserved in archives or on the Web. Only rarely have I consulted memoirs or interviews with the dramatis personae of computer history.[5] They are generally more interested in explaining their own farsighted decisions than in tracing the course of history. They acknowledge a past with limited horizons (not theirs, of course) and compare it with an ungrateful or ignorant present. In doing so, they forget that the reduction of uncertainty is an inexact science and that the path to wisdom is rarely straight.

This is basically another way of saying what my history of the computer takes into account and what I wish to disregard. I rely heavily on the extensive holdings of the Association for Computing Machinery, because they provide very detailed information about motivations for shifting things into computers.[6]

The process of communication comprised both discreet and overt announcements, long and short explanations, big promises and little promises, both from within and outside the self-proclaimed group of experts. In the first promotional film in digital history around 1951, for instance, computer manufacturer Remington Rand held out the sort of promise that could easily find resonance today.[7] Like any advert, this one broadcast an upbeat message and, at its most superficial level, conveyed unbridled optimism at the progress made by civilization and technology. The recently founded company created a suitably impressive backdrop for the cinematic debut of its all-purpose computer. From the pyramids to urban skyscrapers, from the triumphs of scientific research to the mass production enabled by automated industrial plants, to the services of modern forms of government – the ensemble of spoken words and images served to evoke

the foundations and achievements, and the history and future of humankind. The arrival of UNIVAC overshadowed prior progress, and put it on a new footing: from now on, the entire world theater would benefit from the computing skills of the machine. UNIVAC, the first commercial digital computer ever, had freed itself of the main tasks of previous computing machines, which had consisted of calculating ballistic curves, cryptography, and the development of nuclear weapons of mass destruction.[8]

The Remington Rand promotional film presented the computer as the crowning achievement of civilization's development and, at the same time, as its instrument. The film explained in detail the various components, procedures, and possible uses of the computer, including coding stations, punched card readers, magnetic tapes, monitoring consoles, processors, memory "tanks" and printers – all surrounded by a scattering of humans. Mention was made of the amazingly fast solving of complex systems of equations in nuclear physics, but the focus was on the bureaucratic mass processing of data on the digital assembly line.

Particular emphasis was placed on the meticulous programmers and skilled operators who managed the machine. The computer was an automated, industrial, well-controlled calculating monster in the service of humankind. It came across as a smoothly functioning manufacturing system, fed with raw data that went through a whole series of processing steps and emerged as fully calculated and neatly printed results. These results might be thousands of payroll checks for a large company with deductions for taxes, social security, and union dues as well as individual adjustments for overtime, vacations, and night shifts all figured in. "In less than four hours per week, and with only a small operating staff, UNIVAC can complete the computation for this payroll of 15,000 employees. A saving in time and money that is tremendous."[9]

The capability of the system beggared credulity. It could handle "any task where data have to be processed or problems solved," making it clear that "tomorrow's office production will attain the high levels of speed and efficiency which mark industrial production facilities today."[10] The printer, for example, could print out a full three pages of a metropolitan telephone directory with names, addresses, and telephone numbers in less than one minute. Moreover (and this was the real kicker of the marketing film), "UNIVAC still has nearly 90% of its working week free to perform many other valuable computing assignments."[11]

With that, the film upended the relationship between the world and the computer, and also communicated something else with far-reaching consequences. Suddenly, the key message was no longer the grand unveiling of the new machine and its potential spread throughout the world. Rather, the message was that the computer offered uncharted territory to exploit.

The "all-purpose" computer had space – lots of space, actually. UNIVAC's space was so immense that it could accommodate all kinds of projects. Indeed, "the whole world" (or, at least, everything relevant to the world) would one day come to occupy this technologically generated, recently conquered, but still minimally structured digital space. A poster from that time depicts a Remington Rand computer commissioned by US Steel encircling the world and drawing it into its state-of-the-art computer room.

Inviting the world into the computer room had the effect of populating the computer with data, for example, from the most recent US census. From a computational point of view, the analysis was not a difficult task, but it was an extremely laborious one. The results of the previous census in 1940 were still being tallied when UNIVAC made its appearance. Yet the new machine handled the processing of the even more comprehensive 1950 census with ease and delivered the first results within a few weeks.[12]

Figure 1: The world of US Steel moves to UNIVAC in 1956.

Thus, it made perfect sense to enter the census data into UNIVAC. There even was an IT precedent for doing so. In 1890, Hermann Hollerith had supplied the Census Bureau with his electromechanical punched card machines, making it possible

Figure 2: UNIVAC sorting Democrats, Republicans, and undecideds during the 1956 presidential election.

to calculate the results of the 1890 census in under a year. In contrast, analysis of the 1880 census had required an additional eight years.[13]

The UNIVAC was also entrusted with tallying the 1952 US presidential election. During a CBS news broadcast, the computer projected victory for Second World War hero and Republican candidate General Dwight D. Eisenhower. What made the event so spectacular was not only the remarkably fast computing power of the machine but also that it foresaw the defeat of Democrat Adlai Stevenson, who had been favored to win.[14]

The world (or much of it) was also gravitating toward the computer for making faster weather predictions. Data from guided weather rockets and weather stations – "all of this can be fed into the computer through these magnetic tapes," explained the host of another Remington Rand[15] commercial, gesturing to banks of tapes lined up like trusty servants.[16]

The arrival of the computer was thus accompanied by a grand narrative. This narrative had to be told over and over by everyone involved both to help grasp events as they unfolded and to help endure the arduous work ahead. My account of this effort also relies on storytelling. Not because there are no analytical concepts to explain. I am compelled to tell stories because it is stories told in the past that moved the world (into the computer).

This narrative history is organized by the basic activities that shaped digital space and made it a reality. These activities include computing, programming, and formatting (Chapter 2). They make a good starting point because they figured particularly largely in the 1950s, and continued to remain important afterward. In the early 1960s, people began to formulate rules for sharing scarce resources and thus also rules for operating in digital space, that is, time-sharing and operating systems (Chapter 3). Around the same time, the issue of synchronizing the world with digital space became acute, as the example of the Houston Space Center (Chapter 4) shows. Indeed, the delicate matching of IT supply and demand runs like a thread through the history of the computer. Bringing the two together required endless negotiation. While manufacturers worked on the machines and programs of tomorrow, customers sought to clarify what it was that they actually wanted to do in digital space and how to go about it. Projects of varying scope provided a means of adapting customer expectations to the possibilities of digital space (Chapter 5). By the 1990s, networks of computers, differentiation of users, and routine storage of data had served to structure digital space in such a way as to produce a globally recognized digital order. Ever since then, the world's communications and transactions have found firm anchor – albeit in rapidly changing configurations – in digital reality (Chapter 6).

The form of this story is an essay. What happens when the usual perspective of computer history is reversed? Do new in-

sights emerge? What can simply be left out of the conventional narratives and what should receive greater emphasis? For me, there is a clear advantage to this exercise. By beginning with contemporary problems whose solutions had to be negotiated and whose implementation invariably led to new, unintended consequences, it is possible to recount computer history in such a way that its outcome need not be regarded as inevitable. And that matters if we are to understand why the world – even in the computer – is always subject to reinterpretation.