50 & 25 YEARS AGO

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JULY 1970

We will be skipping July 1970, and the next time content from the 1970s will appear is in the September issue.

JULY 1995

www.computer.org/csdl/mags/co/1995/07/index.html

The End of Work as We Know It (p. 10) "In the United States alone, corporations are eliminating more than 2 million jobs annually. Men and women everywhere are worried about their future. … He goes on to explain how the computer revolution has reduced the US manufacturing workforce from 33% in 1950 to 17% today. Meanwhile, from 1979 to 1992, productivity increased by 35%. This is a result of computerization, not foreign competition. … We have entered the info age, where virtual worlds replace factories and telepresence replaces commuting. … The hierarchical, monolithic, assembly-line manufacturing plant is a relic of the industrial age. This dinosaur is sinking in a swamp while the fleet-of-foot SOHO (small office-home office) is taking over." (p. 11) "It's not as difficult to prepare for the info age as it might sound. … Whatever your formal training, don't forget to keep your info age skills sharpened. In the future, expect to see the end of work, over and over again." *[Editor's note: Looking at the United States and other developed countries, the manufacturing loss did happen. However, the article totally missed the coming of two things: first, the tremendous rise in the global economy, with huge manufacturing organizations in countries like Korea, China, and Vietnam, and second, the growth in service industries of all kinds, such as banking, logistics, sales, and support.]*

Guest Editors' Introduction: Virtual Reality: In the Mind of the Beholder (p. 17) "The elements: Interaction is the process of inputting data to the system and receiving data from it. The 3D graphics, a form of computer output, let users 'see' the virtual environment. Immersion refers to the user's feeling of 'presence' in the virtual world. An immersive application convinces users that they are in a replicated environment." (p. 18) "Our playbill features medical imaging, psychological treatment, simulations, visualization, and terrain database construction. In contrast, the media have glorified frivolous VR applications, touting VR video games, ignoring serious research, and making outlandish assertions about VR as if these advances were already accomplished." *[Editor's note: This view, of course, misses the fact that so-called frivolous applications have been driving the field for many years. Cost reductions and sophisticated hard- and software were the result of those developments.]*

Two-Handed Spatial Interface Tools for Neurosurgical Planning (p. 20) "Neurosurgery is inherently a three-dimensional activity. It deals with complex structures in the brain and spine that overlap and interact in complicated ways." (p. 22) "Therefore, in Netra, users manipulate virtual objects seen on a standard workstation monitor by moving the props with their hands. Since many people associate the phrase 'virtual reality interface' with immersing head-mounted displays, we often characterize our system as a *spatial desktop interface*—spatial because it involves moving six-degree-of-freedom input sensors in free space, desktop because it uses a standard monitor on the user's desk." (p. 25) "Proceeding from a presurgical plan to the actual patient in the operating room requires transforming the coordinate system *I* of the volumetric image data to the coordinate system *L* of Leksell space. This is accomplished by imaging the patient on the morning of surgery with a Leksell frame that has been attached to the patient's head and fitted with a special fiducial system." *[Editor's note: This is a very interesting article concerning the interaction between virtual objects and the real world; many of the things discussed have now moved into mainstream medicine, especially in the area of microinvasive treatments.]*

Virtual Environments for Treating the Fear of Heights (p. 27) "Acrophobia, a simple phobia, is characterized by marked anxiety upon exposure to heights, by avoidance of heights, and by interference in functioning as a result of this fear. Behavioral therapy of acrophobia has included

Digital Object Identifier 10.1109/MC.2020.2988954
Date of current version: 1 July 2020

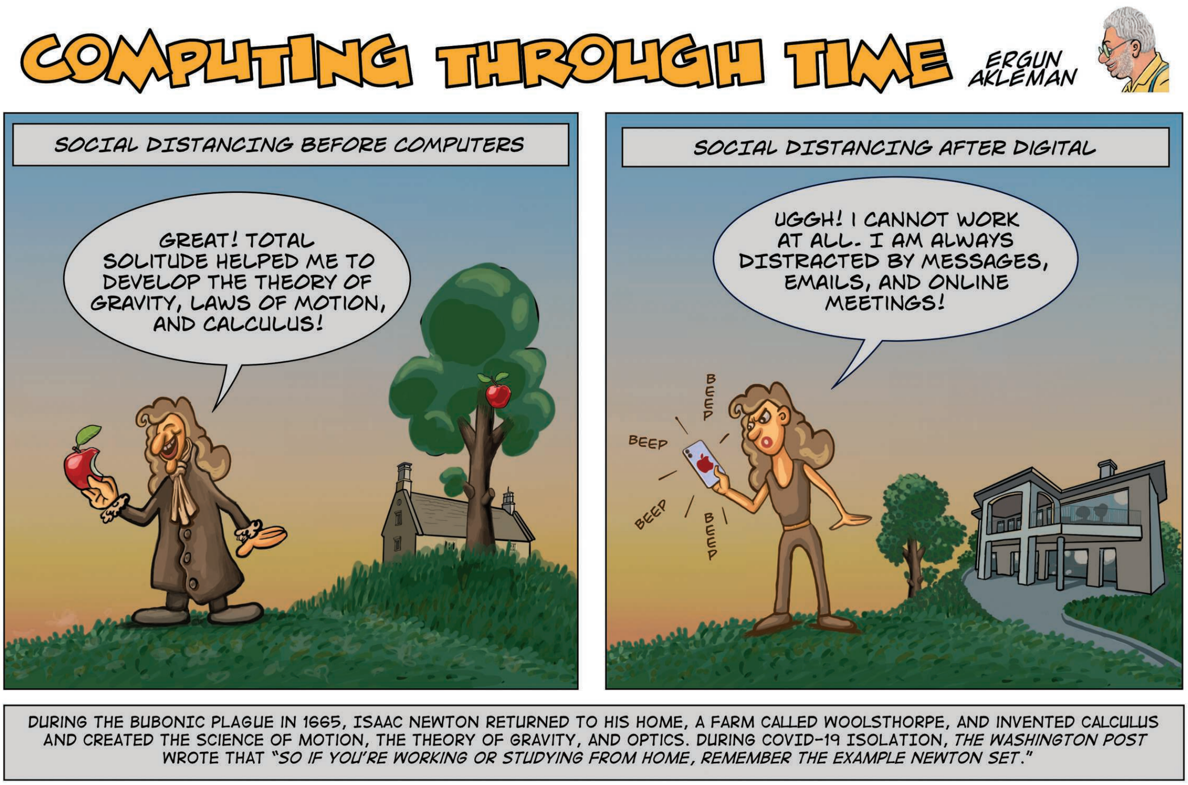
exposing the subject to anxiety-producing stimuli while allowing this anxiety to attenuate." (p. 28) "Building environments for therapy, we designed a number of virtual height situations to correspond to the types used for in vivo stimuli. … We created three virtual environments for use in the therapy sessions: an elevator, a series of balconies, and a series of bridges." (p. 32) "In summary, our controlled study of applying virtual reality to exposure therapy of acrophobia has yielded remarkable results. … Subjects experienced a range of physical anxiety symptoms consistent with the apparent threat they encountered. The degree of anxiety and habituation observed would not have occurred unless the subjects felt present in height situations." (p. 33) "We have documented evidence for the experience of a sense of presence in an immersive virtual environment. We have also shown that a person's perceptions of physical-world situations and behavior in the physical world can be modified by experiences in a virtual world." *[Editor's note: Around the same time, other applications, for example, fear of flying, led to similar results. Of course, using virtual reality (VR) for learning and training purposes has become mainstream during the time since 1995.]*

The Iowa Driving Simulator: An Immersive Research Environment (p. 35) "This simulator's rich, fully interactive environment provides varied scenarios for meeting experimental needs—for example, engineering evaluation of automated highway systems. … The IDS immersive virtual environment represents the driving experience with a maximum degree of fidelity and realism. To achieve this, it provides a full range of sensory cues—visual, motional, auditory, and haptic—to the driver of the simulated vehicle. The driver is placed in full control of this vehicle, which is represented by a detailed, physics-based mathematical model." (p. 40) "With support from ARPA and assistance from the Army Combat Systems Test Activity, an IDS virtual proving-ground environment that closely duplicates two test courses at the Army's Aberdeen Proving Ground (APG) has been developed. … The data from these experiments is still being analyzed, but initial results indicate a high degree of correlation between on-course and simulator data for basic driver-performance measures: vehicle speed versus position on course, steering behavior, and pedal use." *[Editor's note: Since 1995, VR applications for learning and training have developed rapidly and moved into the mainstream, but they have also been used in other areas, for example, in technical and performance simulations in all kinds of planning systems.]*

The Responsive Workbench: A Virtual Work Environment (p. 42) "Although as yet unrealized, the vision of an ultimate medium—using all of the human senses—is leading human-computer interface design toward virtual reality systems. … These approaches aim for a universal interface (that is, intended for all users). …" (p. 43) "Because we believe that responsive environments offer great potential for the human-computer interface, we developed the Responsive Workbench as an alternative to other multimedia and virtual reality systems. … The Responsive Workbench resulted from a joint effort of computer scientists, engineers, architects, and physicians to design a virtual environment. This article analyzes the working environments and behaviors of different users. …" (p. 47) "Initial results showed that a virtual environment requires a high-resolution color display (at least 1280 × 1024 pixels) and real time rendering capability of complex objects with significant reflection and texture properties. The advantages offered engineers by the Responsive Workbench as a nonimmersive virtual environment compared with the BOOM system, for example, are the cooperative work setting and the incorporation of multisensory interaction models." *[Editor's note: Nonimmersive as well as immersive VR systems have rapidly developed since this article was published. Again, like in other areas, the game industry has driven the development of many system components and led to competitive pricing structures.]*

A Large-Scale Complex Virtual Environment for Team Training (p. 49) "Virtual environments that allow multiple participants to cooperatively interact present complex design problems. This Army program's approach relies successfully on concurrent engineering, spiral development, and usability engineering. … CCTT is a US Army program that when completed, will train ground combat tank and mechanized infantry forces on simulated equipment using a high-fidelity representation of actual terrain. Although CCTT is primarily a training system, its simulations will eventually be used for analytic studies, scientific experimentation, development activities, and engineering analyses. The CCTT system consists of networked simulators and workstations that collectively provide a virtual environment for training units to meet established Army standards." (p. 55) "We are pioneering methods to achieve this, which may serve as prototypes, through spiral software development and periodic user evaluations." *[Editor's note: This interesting article investigates, in detail, the pro and cons of systematic software development, in this case, a large virtual environment with 50 different user interfaces and half a million lines of code to be used for various U.S. Army applications.]*

Automating the Construction of Large-Scale Virtual Worlds (p. 57) "Databases for large-scale virtual worlds have several critical applications. Automating their construction can improve fidelity and save considerable time. … The focus of this article is the process by which the synthetic environment's geographical component is constructed to model the real world with sufficient fidelity to support effective training and rehearsal. … Many simulation projects require the data construction team to significantly augment standard Defense Mapping Agency (DMA) products to address critical issues of timeliness, local geographic intensification, and operational security." (p. 63) "One key task in rapidly constructing virtual worlds is updating existing cartographic source material in a timely manner with new information extracted from imagery." (p. 65) "This area



Digital Object Identifier 10.1109/MC.2020.2991275
Date of current version: 1 July 2020

has much to gain from automated computer vision for mapping through stereo and monocular image analysis. At present, such methods still require manual correction. However, given appropriately high-resolution imagery, these methods offer a credible first pass at building detection and delineation. Continual improvements in such capabilities will enable population of virtual world databases quickly and cheaply." *[Editor's note: The semiautomatic construction of virtual worlds as images of real ones plays an important role in road, building, and recreational-area construction. This article presents an analysis of the problems encountered. In part, they stem from the many inhomogeneous data collections that have to be integrated into one simulation basis.]*

National Productivity and Computers (p. 66) "We are the first generation of Americans who think that our children will not live substantially better than we do. This article takes a hard look at US productivity, education, technology, and the prospects of improving national output. In the United States, national output has been growing very slowly over the past twenty years, and the average real wage has been stagnant. What little growth there has been is due to a growing work force and largely to the entry of women into the working world." (p. 67) "The Rise of Science: The war's end brought about another change that had both good and bad effects. The great and very visible achievements of scientists during the war—for example, the atomic bomb and radar—gave both politicians and the public a feeling (and in my opinion a correct feeling) for the immense power that resides in scientific knowledge. And this thought—that science is power—led to a government emphasis on science and basic science support. … As a consequence, manufacturing went its own way toward an eventual rude awakening. … Education: Like science and advanced technology, education is something that the US turns to in moments of crisis. But it is often brought in as an explanation of more than it can explain. … US schools below the college level are widely, and probably correctly, believed to have decayed. Their students certainly have test scores lagging behind those of many other advanced countries." (p. 69) "Ways of Working: In the 1970s, I had the opportunity to visit Japan … but much more important was the inherent excellence and rapidity of the Japanese development and manufacturing effort." (p. 72) "And this is complicated by the possibility that the same skills you have may be available in a less developed country at a much lower price. And cheap sea transportation and cheapness of information transmission are rapidly making that competitive person into the person next door." *[Editor's note: In this very interesting article, the author foresaw the transfer of manufacturing outside the United States but did not see that the service industry would rise to preplace, to a large degree, the jobs that got lost. However, it was correct that, at the same time, job security and increased earnings got lost. In that way, maybe, with the exception of the IT industry, we do not live better than our parents did.]*