50 & 25 YEARS AGO

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In the early years, *Computer* was published bimonthly. Therefore, we will have to skip our "interesting and/or informative" extractions for February. The next one will appear in the March 2023 issue of *Computer*, and we hope you will eagerly wait for our next publication of this column.

However, there is good news. Starting in March of 1973, *Computer* was published monthly. So from March on, you will have the opportunity to read my brief extracts from the 50-year-ago issues every month.

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Are Components the Future of Software? Don Kiely (p. 10): "Because of this, some software engineers are turning to component-based software development (CBD). This strategy uses tested software components and frameworks to eliminate redesigning and redeveloping the same software features repeatedly, as is often the case now. … Multiple standardized interfaces would have to be interoperable to make CBD a viable development strategy. The OMA, which will incorporate CORBA, includes specifications for interactions between ActiveX and JavaBeans." *[Editor's note: Since starting 25 years ago, this heated discussion has been going on in multiple issues of* Computer. *We now know that, especially in the area of apps, software reuse has been and is an important concept of development.]*

Antivirus Technology Offers New Cures; Lee Garber (p. 12): "Over the years, the antivirus industry has had to keep pace as virus writers have become more sophisticated. Antivirus products now not only detect and eliminate viruses, they can even delete or repair infected files, and remove infected sectors from system memory and disk drives. … Some of this research is based on the similarities between human and computer viruses. Both types of viruses latch onto a host, use its resources to reproduce, and cause a range of symptoms." (p. 13) "A self-replicating program called 'Cookie Monster' that some MIT students wrote as a prank for the Multics operating system affected the MIT network in 1970 and spread to other networks. Some observers consider this to be the first computer virus." (p. 14) "Viruses have become a particular risk with the advent of Internet technology, which makes it much easier to pass and spread viruses." *[Editor's note: Interestingly, this article discusses various techniques to detect viruses, but it is very realistic in not promising to successfully "conquer" the problem. As we now know, the problem may have become worse, not the least because of the "cyberwar" programs where governments contribute huge resources to increase virus effectivity.]*

Perspectives in Optical Computing; H. John Caulfield (p. 22): "Optical computing is dead only if we foolishly define it as the attempt to supplant electronics. The hope for optics lies in doing things that are provably impossible for electronics." (p. 23) "The only way for optical practitioners to win the "war" with electronics is to abandon it. Optics can do marvelous and useful things electronics cannot, and we must base our systems on these. …Classical optical processors involve Fourier optics—those used to perform Fourier transforms. Recently, wavelet analysis has joined that technique as something both pure electronics and optoelectronics (a hybrid of optics and electronics) do well, and there are legitimate choices to make in this area." *[Editor's note: As we now know, the predictions in this article were overly optimistic. Except in small niches, optical computers never made any impact and are still waiting for a killer application.]*

Exploring Steganography: Seeing the Unseen; Neil F. Johnson et. al. (p. 26): "Steganography is an ancient art of hiding information. Digital technology gives us new ways to apply steganographic techniques, including one of the most intriguing—that of hiding information in digital images." (p. 30) "To determine the limitations and flexibility of available software, we evaluated several steganographic packages. Here we discuss only three: StegoDos, White Noise Storm, and S-Tools for Windows." *[Editor's note: This interesting article describes, in an*

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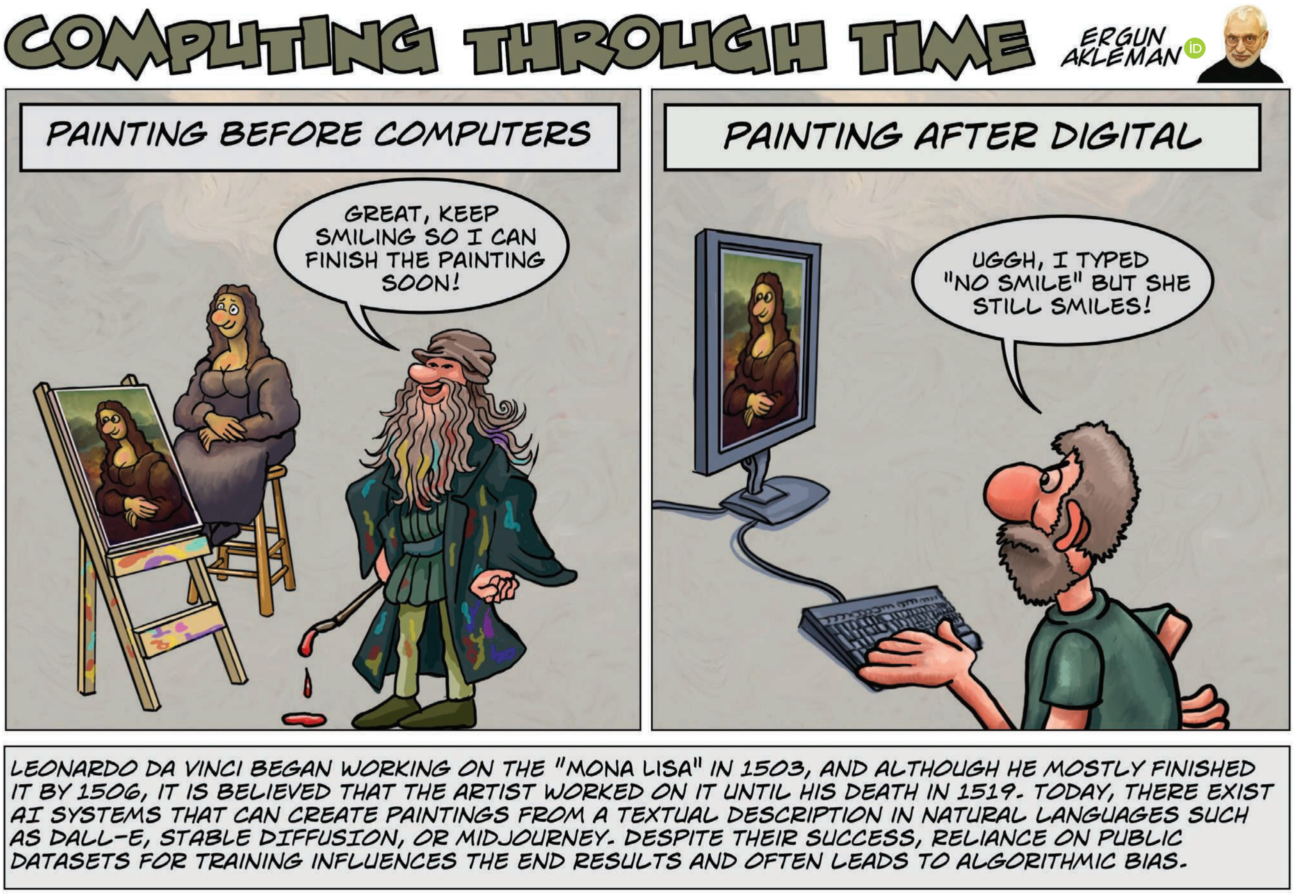
introductory way, the goals of Steganography and uses demonstrative examples for the explanation of the effects when using it. Many new such tools exist nowadays and can be downloaded for free.]

Guest Editor's Introduction: Optics: A Maturing Technology for Better Computing Leo J. Irakliotis et. al. (p. 36): "This issue presents a tutorial introduction to the field of optical information processing, in particular, digital optical computing. We present current trends in optical computing research, in the hopes of a closer interaction with the broader computer science and engineering community. … Figure 1 compares electronics and optics in four domains, which represent the four major computing engines: • Memory • Data transport • Data processing • Devices." *[Editor's note: As we now know, only "Data Transport" has had the impact foreseen in this short editorial. Unfortunately, the following articles, which I will only briefly describe, all concentrate on the other three domains and, as a consequence, did not have the follow-up research to make them commercially successful.]*

Development of Free-Space Digital Optics in Computing; Pericles A. Mitkas et. al. (p. 45): "Used as special-purpose architectures, optical or optoelectronic processing systems can enhance the performance of electronic computers. … The computing paradigms we discuss here can be classified according to three categories: • Analog optical processing, • digital optical processing, and • analog-digital hybrid optical processing." (p. 50) "Optoelectronics cannot meet all these requirements and therefore is limited to special applications such as those described in this article." *[Editor's note: The article describes approaches for all three categories but is also realistic about the general feasibility of optical computers. Again, none of the described approaches made it even into the limited range of described applications.]*

Holographic Data Storage; Demetri Psaltis et. al. (p. 44): "Digital data storage using volume holograms offers high density and fast readout. Current research concentrates on system design, understanding and combating noise, and developing appropriate storage materials. Possible applications include fast data servers and high-capacity optical disks." *[Editor's note: The article describes various approaches for optical storage and is enthusiastic about their success. As we now know, none received wide acceptance, for example, optical movie disks.]*



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Optically Interconnected Parallel Computing Systems; Masatoshi Ishikawa et. al. (p. 61): "Researchers have developed an architecture for high-speed computation, image processing, and robotic vision systems that uses both the programmability of mature electronic technology and the density and parallelism of high-speed optical interconnects." (p. 67) "By taking a modular approach in the design of the optics and opt mechanics, we can easily extend our system to more complex architectures—for example, those consisting of several layers of PE *[Editor's note: processing element]* arrays." *[Editor's note: The authors describe in detail some of the approaches for optical light transmission: among them, fiber optics to connect computer clusters and long(er) distance fiber-optic networks. Here, of course, their predictions were successful but not in detailing possible chip-level interconnections.]*

Free-Space Interconnects for High-Performance Optoelectronic Switching; Peter S. Guilfoyle et. al. (p. 69): "Two architectures have been developed that use and demonstrate free-space optical interconnects for digital logic: a high-performance optoelectronic computing module and a second-generation digital opto-electronic computer.... The HPOC *[Editor's note: high-performance optoelectronic computing]* modules, which incorporate arrays of micro-lasers, diffractive optical interconnect elements, and detectors, are currently undergoing prototype fabrication." *[Editor's note: The article mainly investigates chip-to-chip optical interfaces in detail, but as we now know, this approach, like others, did not become an established technology.]*

Toward Systems Ecology; Andrew P. Sage (p. 107): "A biological ecosystem wastes virtually nothing, as the metabolic products of one organism are useful to another. Each process and network in a biological ecosystem is a dependent and interactive part of the larger ecosystem. ... An ideal organizational knowledge strategy accounts for future technological, organizational, and human concerns, to support the graceful evolution of products and services that aid clients." (p. 108) "A number of people have observed that the global revolution in information technology could lead to participation by all societal sectors in decision-making. This could lead to more effective global governance. On the other hand, information and knowledge can make an already powerful elite even more powerful if those without access (generally the already poor and less educated) remain so. ... If we can change our attitudes and embrace more functional, less product-oriented consumption, we can direct the wealth of nations toward technological innovations that enable sustainable world growth and development." (p. 110) "It is perhaps not an overstatement to say that sustainable human development is unrealistic without major reliance on information technology. Yet without a cohesive systems ecology to guide the use of information, how can we expect to manage today's complex systems? Whether they be man-made, human, or organizational, systems based on a systems ecology could more quickly lead to knowledge and enterprise integration for the betterment of humankind." *[Editor's note: The concerns expressed in this very interesting article about sustainability in our world ecology are at least as urgent today in our pandemic-, war-, and economy-rattled world as they were 25 years ago.]*

Computer Science and the Pygmalion Effect; Joao Carreira et. al. (p. 116): "Whenever someone evaluates something, the evaluator's expectations concerning the evaluated object influence the evaluation, in a way that tends to prove the evaluator's initial hypothesis. ... Rosenthal and Jacobson demonstrated that the expectations of the evaluators can strongly bias the outcome of the evaluation. Most of the time, they found, the evaluators perceive neither that they have any such expectation nor its enormous power. ... Computer scientists have not studied it in any depth, although we believe the Pygmalion effect is very prevalent in our profession." (p. 117) "The fact is that one group of people clearly understand the potential of the Pygmalion effect and use it intensively: the marketers. Good marketing can create positive expectations for a product and thus foster the Pygmalion effect. ...It is our responsibility to find it, uncover how it is influencing us negatively, and do something about it. Any clues?" *[Editor's note: I consider this a very important article well worth reading and would expand its scope beyond marketers to lobbyists, statisticians, opinion pollsters, and even politicians. Many of the troubles we have today are a result of the unchecked use of the Pygmalion effect.]*

Salvation from System Complexity; Harold W. Lawson (p. 120): "Current computer and communication structures contain significant unnecessary complexity. ...The presence of complexity inevitably leads to risks. Risks lead to exposure and hazardous situations, which inevitably lead to failures and accidents as well as malicious and criminal acts. ... This complexity stems from two main factors: The first is the provision of too many software functions. Some observers may not see this fat as harmful, yet it adds significantly to the sources of risk. The second, unnecessary complexity arises from the mapping of application functions—via programming languages, operating systems, protocols, and middleware—onto poor or inappropriate execution platforms." (p. 119) "In service-oriented computing, CISC *[Editor's note: complex instruction set computer]* and RISC *[Editor's note: reduced instruction set computers]* processors are dominant. However, to enable architecture restructuring, a new form of processor must evolve, Function Integration Micro-processors. FIMs provide a flexible micro-programmable machine adaptable to a wide variety of tasks. As complicated and multifaceted as computers have become, it is impossible to be revolutionary; change must be evolutionary. The FIM approach provides a means of backward compatibility as well as an opportunity for to new solutions." *[Editor's note: This is a very interesting analysis. In looking backward in time, two solutions have evolved. On one side, very large module libraries, especially for Internet apps, led to much lower efforts in new app development. On the other hand, field-programmable gate arrays with their flexibility again allow a decrease in system complexity.]* C