Former *CiSE* EICs Reflect on the Magazine's 20th Anniversary

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Long titles have become popular of late. An appropriate long title for this essay might be "How, While I Wasn't Noticing, Computing Took Over My Life So That I Could Become One of the Founders and EICs of *CiSE*." But my real theme in this essay is the unifying, educating, and revolutionary role that computing has played in modern science and engineering. Encouraging the use of computing in making connections, in educating both students and experts, and in exploring exciting topics is what *CiSE* has been (and should continue to be) all about.

I'll try to illustrate this theme using some personal history. I started college hoping to become a theoretical physicist—someone who would write profound equations on a large blackboard and, perhaps every now and then, do a small calculation to check my latest conjecture. The astounding development of computing over the past 50 years changed my notion of what was important to try to do. It also formed my view of what scientific information truly is, how to get it, and how to pass it on to others.

My first encounter with what was then called "digital computing" was in early 1961, just before I finished my BS in physics. My memory for events more than 55 years ago isn't completely trustworthy, but I do recall that I was taking a second course in ordinary differential equations, and the text (by Ralph Palmer Agnew) had a chapter on numerical integration. I had also signed up for an introductory course in programming. From that potent mix—a programming course plus Agnew's book—I began to understand what integration really is and why an integral is an anti-derivative. I also decided that, to understand the relationships among physics, mathematics, and computing, I would need at least a PhD in mathematics. I don't think the terms "computer science" and "computational physics" were then in general use. And besides, even if there had been CS departments, I wanted to understand what I thought were the real foundations of science: physics and mathematics.

After I graduated, I got a job at the Westinghouse Astronuclear Laboratory (WANL). WANL had a government contract to design and build a nuclear reactor to be used as rocket propulsion to explore parts of the solar system. WANL had access to a supercomputer of the day—an IBM 7090. Few of the staff members in our group actually wrote programs. We mainly used the 7090

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for running codes to check design proposals. Some codes were developed elsewhere at WANL, and others came from Los Alamos National Lab. Junior members of our group used desk calculators to take output from one program, do some pretty extensive computations on this output, and then feed the result to another program. This was important, but it could get a little boring and nerve-wracking—one mistake on the desk calculator could lead to a useless 20-minute run on the 7090.

By great stroke of luck, one day I noticed that the tedious exercise was really just a matrix multiplication. The vector was a row, and a column was the desired output, so somewhere in the chain of operations there had to be a matrix transpose. So, I wrote a program for transposing and multiplying that produced as output punched cards to be input for the next program. That was very interesting because limited memory dictated that both data and programs had to be written out to tape and then read only as needed. The programmer had to explicitly construct the data movement.

Victory was not total, however, because some people stuck with the hand-calculation. The fact that the "punch" command generated a -0.0 for a zero worried some colleagues. But I had learned important lessons: first, that computation itself can be exciting to think about, and, second, that no matter what computation you're facing, it's a good idea to ask yourself what's really going on and whether it can be done more simply and efficiently. It's no accident that mathematics has been called the science of avoiding work.

The fact that I had written at least one "real" program got me my next job at Gulf Oil's research lab. That was definitely a position in computational science. In addition, it paid a slightly higher salary and provided paid time off to take graduate classes during the day. The arrangement led to a PhD in mathematics and a job with the University of Pittsburgh, where the CS department was just getting started. Even then, universities didn't quite know where to put someone interested in actually doing computations. So, while my "real" job was in the CS department, I was also given a courtesy appointment in Mathematics.

If I could, I'd now use the old-style movie trick where the passage of time is indicated by pages being blown off a calendar. I had a series of jobs, all of them interesting, most of them in CS departments, and all the while thinking that I should really get back to that physics stuff. In 1982, I moved to the Scientific Computing Division at NBS (now NIST) where, at last, I could do physics—computational physics! Well, to tell the truth, what I was really doing was applying ideas learned from years of contemplating *The Art of Computer Programming*, volumes 1 and 2, by Donald Knuth. The amount of speedup that can be obtained by using the right data structure with the right algorithm still amazes me. Yes, floating-point calculations are at the heart of computational modeling, but data motion is often the real rate-determining factor.

The job at NIST allowed me to meet many researchers, participate in government programs such as the Federal High-Performance Computing and Communications Program, and, eventually, become one of the founders and early EICs of *CiSE*. *CiSE* was founded 20 years ago to connect seemingly unrelated ideas, educate on all aspects of scientific computing, explore emerging topics, and encourage collaboration among researchers. If it had existed in 1960, it could have been my career guide.

It's interesting to think about the origin of mathematics and, as I came to understand, its relation to its "parent" discipline: computation. Computation's first use might have been to estimate the number of mud bricks needed to build the walls of Jericho. From its humble beginnings, computation grew to become our vehicle for understanding the nature of the entire physical world. I hope and expect that *CiSE* will continue to be a broad-based publication that teaches, learns, and, most importantly, spreads the word about the fundamental role of computation in all aspects of human civilization.

NORMAN CHONACKY

CiSE was born with the January/February 1999 issue, the result of a merger between AIP's *Computers In Physics* (*CIP*) and the IEEE Computer Society's *Computing Science and Engineering* (*CSE*). In an introductory article called "Computational Culture Shock," EIC George Cybenko compared new *CiSE* readers to medieval European explorers visiting a bazaar in a foreign capital for the first time—they might be overwhelmed and confused by the great variety of exotic-looking goods in the market.

> *Great cities of any age thrive precisely because they bring together the exotic and the novel in a convenient place. I believe this is a suitable metaphor for CiSE. We will see many new ideas and new perspectives... This magazine, by its very design, has little "business as usual" to offer.*

George's discipline is electrical engineering, but he is a polymath of the first order. How else could he create this brilliant metaphor? What ensued in the following years was indeed a period of cultural adjustment and growing pains, both for the readership and editorship. However, this adjustment period was longer than the "few months" that George predicted, and more painful than perhaps he imagined at the time. My purpose in writing this essay on *CiSE*'s 20th anniversary is to illustrate a less-told story of effort that got us here.

CIP's equivalent of an editorial board was its advisory committee, of which I was a member at the time of the merger. This committee was appointed as a group to the initial *CiSE* editorial board. With it came its vitality, commitment, and leadership. What it found in its first years was an ethos that was different from that of its *CIP* predecessor and an emerging publication that did not serve the clients whom *CIP* originally served.

Unfortunately, some former members of the *CIP* advisory committee left the *CiSE* board in those early years. When I became *CiSE*'s third EIC in 2005, I tried to rebuild the connection with the physics community by going to American Association of Physics Teachers (AAPT) meetings to talk about *CiSE*, asking advice about its content and listening to the attendees' voices. The result was a gradual shift in *CiSE* more congenial to this important constituency and a return of readership from the physics—especially physics education—community.

In the end, the *CiSE* editors and readers have largely embraced the cultural shift. Today's *CiSE* has content that is largely post-transitional. Look at the progression of article topics, and you will see reasons for the entente emerging. In the May/June 2017 editors' column, "Changes to the NSF and Computing in the Physics Curriculum," Associate EIC Steven Gottlieb mentions Partnership for Integration of Computation into Undergraduate Physics (PICUP), which was spawned in the wake of the September/October 2006 *CiSE* issue, "Computation in Physics Courses." That issue's central premise is now being endorsed by and addressed in many NSF projects.

This accommodation to George's predicted "culture shock" is a credit to the resilience of *CiSE*. This is exactly what we are celebrating. What better endorsement of the opportunity George envisioned for *CiSE* in the closing passage of his essay:

> *CiSE is setting up camp at the confluence of two great intellectual rivers: the physical sciences and the computational sciences. This camp will grow into a town and then a city, but only if we learn each other's languages and trade in good faith.*

We've learned the language and kept the faith, George. Thank you for challenging us.

ISABEL BEICHL

When asked to reminisce about my tenure as editor in chief, I thought first about the great editorial board I had, whose members helped enormously and to whom I am most grateful. People might think that membership on the editorial board is mostly an honorific. It was not so in this case. Members of the board handled manuscripts, suggested topics for special issues, and found guest editors to put the issues together—if they did not do it themselves.

Editorial board meetings were always lively a□airs where board members gave presentations assessing the quality of the latest issues and columns. There were also many discussions on where the computational science field was heading. It was a very diverse group with representatives from industry, education, and government, and from physics, mathematics, computer science, and engineering. Even more important, they were willing to help me when I asked.

So, I express my deepest thanks to the editorial board and my thanks to the IEEE Computer Society for making this all happen. Best wishes for another 20 years.

GEORGE K. THIRUVATHUKAL

> *It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair, we had everything before us, we had nothing before us—in short, the period was so far like the present period, that some of its noisiest authorities insisted on its being received, for good or for evil, in the superlative degree of comparison only.* —Charles Dickens, *A Tale of Two Cities*

I know it is an overworked cliché, but I have always tried to live my professional life with the hope that I leave something better than I found it. And it is easy to think something can be dramatically improved when it is already pretty darn good—especially when you are "standing on the shoulders of giants," including my predecessors Francis Sullivan, Norman Chonacky, George Cybenko, and Isabel Beichl. When I joined *CiSE* in the 2000s, I was coming to a great publication that was fulfilling a need in the computing community. Even under the best of circumstances, it would take an enormous effort to make *CiSE* better than it already was.

As I entered my tenure as EIC, I quickly recognized the serious headwinds facing professional societies, particularly those that operate as publishers. The advent of the web ushered in a digital era in which you could potentially reach every one. The only problem—and one that plagued most of the newspaper and magazine industry—was that everyone assumed everything was free. So how do we go digital without going broke in the process? As it is, the audience for a title like *CISE* is relatively small. And most magazines (unlike us) advertise and generate revenue from keywords (ad sense) and other social media. We're still not there yet.

At times it was maddening and fraught with uncertainty, and I still wonder whether anyone gets the new media world we're living in. So I did what any academic would do: I focused on the bigger picture. I didn't want the editorial board to worry about all the problems we were facing in financial terms at the Computer Society, even though I informed them regularly of the latest developments (most of which were a bit less than encouraging and difficult to sugarcoat). So we focused on content. Great content. I returned to my early roots in *CiSE* and led by example by organizing at least one special issue a year. It paid off, at least in terms of the quality of our publication. Much to my amazement, I have come to learn that our impact factor rose above 2.0 toward the end of my term, which puts us at the top end across titles within the Computer Society. We managed to do well, even compared to other peer-reviewed journals/titles. (For the record, *PLOS ONE* has an impact factor of 2.77.) Impact factors go up and down, but *CiSE*'s growing

impact demonstrates the potential for the diverse interdisciplinary content that the magazine might uniquely provide to computational thinkers.

While all that was happening, we know that our readers experienced a great deal of heartbreak at times. Many of you wanted print. Although the days of print are—or might soon be—part of a bygone era, I think the focus on digital will eventually lead to a better experience for our community. There has been great progress in bringing ebooks and formats that play nicer with the devices you're likely to be using for reading.

There are other reasons to be optimistic. One idea I raised as EIC while serving on the Magazine Operations Committee and Pubs Board was to have an option for members to select a publication to be included in or added to their membership at zero or nominal cost. As a result, IEEE Computer Society members can elect to receive *CiSE*. While there remains great uncertainty ahead about magazine publishing in professional societies, I encourage anyone reading this message to show your support for *CiSE* and consider becoming an IEEE Computer Society member. This will give you *Computer*, and you can choose *Computing in Science and Engineering* as your additional subscription.

I was blessed during my time as EIC to have a robust editorial board. Being an EIC—a volunteer role in the IEEE Computer Society—is a tough job. Our editorial board has a seemingly infinite number of ideas, and an energy level that would leave even Isaac Newton wondering about the actual energy source, with seemingly no sinks. I'm especially grateful to my associate editors in chief (Jeff Carver, Judy Cushing, Barry Schneider, Steve Gottleib, and Doug Post) and staff at the IEEE Computer Society and American Institute of Physics, who not only provided brilliant input and insight but also helped organize special issues and tracks. The title is in great hands with the new EIC, Jim Chen. So many of us (myself included) love *CiSE* and will do anything to ensure it is with us 20 years from now. And last, but not least, thank you to the authors and readers who have helped to make *CiSE* great (again).