**EDUCATION FORUM**

*Chicago Blues*

I was at STOC this year. At least part of the time. Chicago is a remarkable city, especially so when the Blues Festival is underway. What a contrast! The Chicago Hilton on South Michigan Avenue was the venue of STOC; Grant Park across from the hotel on the shores of Lake Michigan was the site of the Blues Festival—a seething melting pot of languages, skin colors, smells, street food, and the soul-tugging strains of the blues wafting in from all angles. What to do? Listen to the blues being chanted in the general monotone voice of conference presentations (“well, we were able to prove this much, but, by golly, the next step seems elusive…”) or the blues being sung on park greens in deep, throaty tones to the accompaniment of a wailing saxophone (“My wife left me for a rhinestone cowboy and the dog just overdosed on asparagus…”)? The answer of course, was: A lot of both. Somehow, as you might well imagine, the contrast between STOC and the Blues Festival was almost enough to warp a person’s mind (were it not already warped). Ditto for the contrast between the Chicago skyscrapers and the cloud piercing peaks of the Rocky Mountains of Bozeman.

Most of us have heard the remedy for the blues: Play the songs backwards. The wife comes home, the dog gets healthy, and smiles return to faces. What would happen if we played the STOCs and related research backwards? We would wind up moving back past complexity theory, past NP-completeness, past Turing, and even back to the time when it was generally believed that every problem was solvable. What a blissful state that must have been. Ignorance, common wisdom relates, is bliss.

Part of the reason I was at STOC was that I was invited to receive the 2004 ACM SIGACT Distinguished Service Prize. I must admit that I was flabbergasted when the announcement arrived from Mike Langston (he who originally hornswogged me into the job of *Education Forum* editor) that I was to be given this honor. There were two reasons for my utter surprise. The first was that I was, uh (embarrassment here), unaware of the award. The second was that, had I been aware, it still would have been unexpected. My thanks goes to all of the SIGACT community. If I only had time I would look back through my electronic files and compile and publish a list in the *Forum* of the many members of our community I’ve come to know directly or indirectly as a result of writing this column, primarily through correspondence regarding a book they had published that I previewed. It would be a long list gathered nostalgically and fondly. It was a pleasure at STOC 2004 to finally meet a number of the people whose names were familiar to me but whose persons were not, including Hal Gabow, László Babai, Éva Tardos, and many others. As I mentioned at the STOC business meeting, writing this column is like singing to the wind. One seldom knows whether the music is heard. Still, the column is fun to write.

**Visualizing Theory**

As I sat in various presentations at STOC I was struck by the frequent use presenters made of rudimentary visualization techniques. PowerPoint continues to be enhanced to allow presenters to incorporate ever more elaborate animated graphics in a presentation. Although none of the animations at STOC was particularly complex, it was still interesting to me to see that the presenters believed that their often deep ideas could be expressed better with even simple animated graphics. In many cases, elementary animations suffice at a conference like this, because the audience is already attuned to the underlying ideas. When it is time to move new and/or complex ideas into the curriculum, however, more sophisticated animated visualizations are required to help students learn, as students often don’t have a sound basis to build upon for grasping the concepts being presented. I have often written about the work in algorithm and concept animation and visualization. Many of these ideas can be applied to theory as well.

**MatrixPro and Trakla2**

Many different approaches to visualizing algorithms through computer-generated animations have been explored. One such contemporary system is MatrixPro, developed at the Helsinki University of Technology under the supervision of Lauri Malmi. Many algorithm visualization systems, especially early versions, were one-of-a-kind, intended to show the actions of an algorithm on a data structure. Most were passive and,
while entertaining, did little to help students actually understand the details of algorithm design. There also
was generally no accompanying educational infrastructure (e.g., to exercise and quiz students on their un-
derstanding). MatrixPro and its companion software Trakla2 present a comprehensive approach to teaching
and learning abstract data types. With MatrixPro, one can develop ADT animations without being required
to actually provide any code or calls to trigger the animation steps (as is true of many other systems). The
animation is based directly on a student’s Java program.

Trakla2 is an interactive student learning and evaluation system based on MatrixPro. Students can be
asked to produce a response to a question about an ADT that indicates that they understand the ADT.
For example, an exercise might be given that presents a binary tree populated with keys for which the
students are to list the keys in the order in which they would be visited in an inorder search. Answers can be
submitted for evaluation, and feedback is given to the students on the correctness of their answers. Students
can also watch the system produce a correct answer. When a student feels ready to submit an answer to
an instructor, a fresh, randomly generated exercise is given for which the student must again produce an
answer that this time is forwarded to the system for evaluation and reporting to the instructor.

The nice thing about the combination of MatrixPro and Trakla2 is that it represents a comprehensive
approach to teaching and learning ADTs through the use of interactive, animated visualizations, and to
evaluating student learning in automated fashion. More can be learned about MatrixPro in Ari Korhonen’s
doctoral dissertation, found at http://lib.hut.fi/Diss/2003/isbn9512267950/ and by visiting the web sites

Logout

At the STOC business meeting, Hal asked me to read to the audience the logout from a recent Education
Forum. I did, but I first explained the origins of the logout. I have attached it to the end of each Forum
since the beginning to answer the anticipated question, “Why Bozeman?” We all choose a place to live and
serve for reasons that range from monetary, to opportunity to advance in research, to a good place to raise
children, to less tangible issues that have to do with the inner man. Rather than answer “Why Bozeman?”
directly, which I couldn’t, I chose to answer it in the form of an ode to Montana, to the wilderness, and to
my roots.

On the way to dinner one night at STOC I listened to László describe why he loved living in Chicago
and, even though his views are of skyscrapers and mine are of mountains, I could understand as I walked
the promenade along Lake Michigan and watched families come to enjoy the cool breezes on the one side
from the lake and the muted sounds of the blues on the other side from the park. I really could understand.

But I was glad to return home.

From Bozeman, where the heat of the summer sun is rudely interrupted by visitors dark, brooding, rau-
cous, and rowdy—thunderstorms that brew and grow behind canyon walls amongst the unseen crags of the Spanish
Peaks waiting to descend on the unwary—who knock loudly, enter without invitation, and depart as abruptly
as they arrive leaving the air cool, the ground damp, and the waters moody where the anglers stand five miles
from the road on boulders on the banks of the Madison River of the Beartrap Canyon, warily eyeing the sky
and listening to the mutterings and grumblings of the departed echoing in the distance off the canyon walls . . .

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