Hands-off Experiences

We sit in front of our computers, masters and mistresses of the known universe. We command incredible computational and informational resources. We are mesmerized, enthralled, deeply engaged by the endless flow of RSS feeds, videos, Flickr pages, and other networking inventions that seem to multiply effortlessly these days. We are also servants to our machines that demand reboots and virus checks to keep our data flowing.

Engineering becomes a hands-off experience. The keyboard seduces us through the ease with which we can become absorbed in a problem and by our ability to analyze once-intractable problems. The ease of simulation of the physical world that began with the calculation of the trajectories of cannonballs was followed by the analysis of lenses. Now, with ever more powerful machines, any physical system from tomorrow's weather to the birth of the universe can be simulated. And yet….

And yet this computational power has led to a contraction of our focus to the point where we lose sight of where we live: the real world. For example, it is not unusual to send an e-mail to a colleague a few doors down the hall, even though it takes us longer to compose the message than it would to deliver it verbally.

Today almost every classroom has a bank of computers. They replace messy lab setups with neatly packaged simulations of science experiments ranging from simple mechanics to dissection of frogs. I suppose the students become familiar with the effects that are simulated, but I doubt they gain any sense of the heft and feel of the real things. No simulation can evoke the disgust and awe or the delicacy that accompanies the dissection of a real animal.

There are times when I get up from my chair in front of the computer and I wonder what it was that I "did." Yes, some e-mail was exchanged. Yes, I caught up on the news of the world and my interests. But what have I got? Not to worry, I'll continue this afternoon or tomorrow morning. There's another set of RFQs to be scanned and another proposal to be outlined.

In contrast, there's the wall around our rose garden. Over the past 15 years, some of the neighbors up the hill have paved and pooled their yards and the increased runoff nearly washed out the rose garden. After far too much analysis (…on the computer), I designed a protective stone wall above the garden. We hired a mason, but the resulting wall was so unlovely, so pedestrian, that we tore it apart, bought some elegant stones, and, over the space of a very hot week, I learned to build a wall.

Beyond this tangible record, the work provided me with practice for the flagstone walks that we are adding to the garden. It is a hands-on (…or hands-off-the-keyboard) experience that generates new ways of thinking about our world and our problems. No computer program can give you a sense of the geometrical possibilities and aesthetics that come from assembling a stone wall.

It's hard for anyone to get hands-on experience these days. (When was the last time you worked on your car?) It is even more difficult for today's youth to take any device apart. Once you could operate on wind-up alarm clocks. Now, if a child disassembles an alarm clock, he or she won't even find a printed circuit board—just a single-task IC and a display.

When I was in grade school I kept a cigar box beneath my bed. It contained the remnants of early post-war Japanese optics that I bought at the five-and-dime. I used the lenses and prisms in my box to experiment with. They were probably one of the reasons I went into the field. Other components were surplus optics from WWII that were bought from Edmund Salvage Company. I still have a number of them in those little brown envelopes in my basement. Those components in the cigar box were the inspiration for the OSA Optics Discovery Kit.

There are a number of efforts to provide hands-on experience in our keyboarding world. In Montara, California, not far from where Photonics West is held, the Tinkering School provides students with hands-on workshops using beads, glasses, sensors, and displays. Recently, the *New York Times* reported that Adobe has invited the Tinkering School to do the same for about 100 of their software designers whose only hands-on experience is moving a computer mouse. The Adobe management felt that such exercises enhance creativity.

I'm not too sure I buy this. For children, where all experience feeds into their interpretation of the world, this might be true. But for adults, these exercises may have impact on creativity to the extent that they increase intuition. In our case, hands-on experience refines our judgment as we tackle problems. It helps us to answer questions like: Is this the right size? Will this be too heavy? Too flimsy? Will this be too hard to make?

So there you are sitting at your computer constructing another spreadsheet or entering another 3-D CAD model. Take a break. See if there are samples or comparable components, models, old prototypes, or actual devices that can give you a feel for the current device or the system. (Mirror symmetries can play havoc with a system that has never been modeled or mocked up.) As optical engineers, our playground is the real world and our primary toys are light beams.

Put the computer to sleep. Get out of your chair. Go play in the lab.

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