An Appreciation of Jim Levine at IBM

by Dick Garwin
March 16, 2014

LEVINE--James L., died at home at the age of 76. Survived by his Wife of 53 years, Sandra. Sons David (Elanor), Alan (Roxana). Grandchildren Samantha, Brian, Aliyah and Marcus, Sister Suzanne Schulman. After a BS in Physics from MIT and a PhD from University of Minnesota, Jim spent 42 years at IBM Research working on Physics and Engineering where he combined basic research with product engineering yielding over 30 patents. Avid skier, sailor, and traveler. Donations in lieu of flowers to the Union of Concerned Scientists or Hospice Care in Westchester and Putnam.

Published in The New York Times on Feb. 13, 2014

I had the pleasure to work with Jim for his 42 years at IBM, having hired him to the IBM Watson Scientific Laboratory at Columbia in 1962 to do his own research in cryogenic systems—helium gas, liquid, and super conductors. Among other things he studied the lifetime of excitations in superconductors and their diffusion. He was a fine experimenter and built his own He-3 dilution refrigerator.

Jim moved to Yorktown in 1970 with the rest of the lab, and there we began our physics research together on the detection of Joe Weber's gravitational waves. Weber, with multi-ton aluminum bar detectors at Maryland and at the Argonne National Laboratory, was “detecting” some 10 gravitational waves per day, which set the astrophysics community on its ear because such a large fraction of the energy of the universe was apparently going into gravitational radiation. After visiting Weber and trying to persuade him to do a better experiment that would reduce the probability (perhaps certainty) of false detections, we decided to do a proper experiment ourselves at the same (audio) frequency of 1600 Hz. And, by the way, we would do it for no money and without buying anything. So we cobbled together a bell-jar vacuum chamber to eliminate airborne acoustic excitation of the 260-lb aluminum bar (later 1040 lb), some 5 ft in length, decided that there was a good probability of reducing all noise background to well below the level of thermal noise, and so were satisfied to have a single such detector in the middle of our lab. We introduced an incremental digital tape recorder and recorded for a full month during which time we should have seen at least several hundred pulses if Weber’s detections were real. We saw only two, and these were probably electrical noise that had escaped our barriers. Incidentally, by “detecting twice” we essentially eliminated the thermal noise of the bar antenna and amplifying system, so that at room temperature of 300 kelvin our overall system noise level was 17 kelvin.

Researchers everywhere then adopted this approach, and we went on to other things. In fact, we then went on to “perfect-resolution displays” that involved the tracking of the center of attention of the eye. In this and all of the other activities I mention, we had the essential help of Mike Schappert, talented technician and engineer.

We took a small detour to demonstrate and publish gaze control of computers, so that a person could sit in front of the display screen and have the cursor follow her gaze, thus allowing hands-free interaction with a computer. There are lots of ways to do this wrong, but we did it pretty much right.

Another aspect of the perfect resolution display (perfect in the sense that the viewer couldn’t tell it from an ideal perfect color, stereo view) was a way to achieve an affordable projection laser display for an individual user. In the laser printers that IBM introduced to the industry, a high-precision multi-faceted mirror is spun at high speed to “write” the image onto a photoconductor surface, to be developed with toner and transferred to paper. We didn’t want to spend the money and time to buy a high-precision mirror, so we machined an aluminum disk and glued multiple mirror flakes on a 40-facet spinner. This then produced 40 different lines on the wall, instead of the single line that a high-precision system would provide. This was intolerable, but we tamed it by remembering experience with a pool table, for which a cue ball striking a cushion and then another cushion at right angles essentially reverses its direction and emerges from the double collision strictly anti-parallel to its initial direction. It doesn’t matter how the right-angle corner is oriented with respect to the initial direction of the cue ball; it always reverses its direction.

If one places on the pool table a long block of wood that *reflects* the cue ball into the corner, such that the ball bounced back from the corner again strikes the block of wood, that block of wood can be placed at any angle, and together with the right-angle corner reflection the result is perfect reflection of the cue ball. Well, all we needed to do was to add a stationary “book mirror” to the laser beam line in order to cure our cheap spinner of its tilt problems; I recall Jim’s demonstrating this like-magic performance to John Armstrong, IBM Director of Research. We had similarly cost-free solutions to misalignment of the mirror flakes in the scan direction.

Our work with the gaze tracker led to simplified versions for many people who do have good control of their heads, even if no use of arms and hands. It was a lot cheaper in those days to provide a mechanical scan than a video camera and interface, and again we used a PC fan motor with the mirror flake, with a split beam retro-reflected from some bit of Scotchlite tape on an eyeglass frame, nose, or forehead so that one could steer a cursor with a small motion of the head. This used the “gesture recognition” (a nod or shake of the head) that we then employed in our major achievement of precision, convenient touch screen inputs.

Here we wanted to have essentially perfect-resolution input with a stylus or fingertip and provided both the technology to apply for instance to the IBM color PC monitor as soon as it emerged, and to a stand-alone lectern that Jim and Mike Schappert made by the hundreds for IBM internal education classes. This incorporated as input a 17-in monochrome plasma-panel display and either a stylus wrapped with retro-reflective tape or a finger if that were desirable. Of course, the audience could not see the lecturer’s display, but the digital picture in color was projected onto the large screen by a color projection system showing the data from the lectern, together with the lecturer’s annotations. This led us to develop also contact sensors for the stylus to improve the handwriting, and eventually several other touch-input technologies besides the laser-scanned input device.

My favorite, though, was the implementation for the IBM color PC, for which we used angle-angle detection of the position of the stylus or finger, say from the two upper corners of the display. After a few days, we realized that the two scanners could be replaced by a single physical scanner plus a virtual scanner, by an appropriate combination of 1-D retro-reflective mirror and retro-reflective tape in a narrow aluminum bezel placed almost invisibly around the display screen.

For this we used our patented gesture recognition with the “back-in-the-stack” algorithm that essentially provided a precision mouse click when the stylus or finger was lifted off directly, while providing cancellation of the input if the user “scratched” on lift off.

I had no involvement with a major part of this work—Jim’s inspired programming for the entire lecture-preparing aspect of the IBM internal education application. For the PC application he programmed an airline-ticket-issuing application; an application for a kiosk that would allow one to bring in a picture and then to choose single or double matte framing, the frame itself, and send the order off to some hypothetical factory that would then ship the frame and matte.

Notably, also, and probably simplest, he programmed a touch-input ATM (Automated Teller Machine) which we very seriously tried to get IBM to adopt. We got as far as a promise from IBM Charlotte that they would do so on their next go around, but, as might have been predicted, when their next catch-up program was kicked off, they had not done the preliminary work and introduced once again a technology-lagging product.

It was evident that we could provide touch input for very large, wall-sized displays, including those provided by long-throw digital projectors. We needed only to affix two small boxes with diode lasers and rotating mirrors on the typical magnetic wall, Whether there was a white board or not, the lecturer could “write” on the projection display with a stylus or pointer, with immediate effect. In fact, styli of different diameters could be recognized as red, green, or blue, and a stylus sensitive to pressure so that its diameter changed when made of foam or some spring material, could change color or line width or density. These were all prototyped and were great fun. We also mounted large panels on force-sensitive transducers, contracting for our own mounts, and Jim and Mike were happy to deal with the “Imagineers” and with the installation at EuroDisney.

I had nothing to do with but great admiration for the technology that Jim and Mike introduced that was picked up as the IBM Assistive Mouse Adapter, with a patent application of December 2002 for a “self-correcting autonomic mouse.” This was honored by The Wall Street Journal in its Second Annual Innovative Technology contest and picked up by a small company, Montrose Secam in the UK. James Cosgrove of Montrose Secam became an IBM business associate as well as a friend of Jim and Sandy.

Looking back on the touch screen, it is a calamity that this was not picked up by IBM, despite major efforts on our part to argue for it within the company, and with the leadership of the Research Division.

We considered, but not very seriously, commercializing this ourselves, but it was before the era in which IBM would routinely see potential benefit in such activities.

Jim was a pleasure to work with, a caring boss, and a good friend. I miss him.