



## FRAMES OF REFERENCE

It was refreshing to read Bob Colwell's column regarding frames of reference (At Random, June 2005, pp. 9-11).

Many "factual" debates are really unstated conflicts among frames of reference. When a person's words or behaviors appear to be "completely illogical," it's time to reflect on where his implicit propositions differ from your own.

Logical outcomes are determined by logical inputs; thus, two people can both be completely logical and yet still arrive at different conclusions. Although we continue to gain knowledge against which these conflicts can be arbitrated, they are exacerbated by the fact that the universe is still so mysterious that we all have no choice but to fill in many blanks.

People and groups do tend to develop self-reinforcing frames in which they either deny, discard, or water down conflicting information to fit into the existing boxes. This is sometimes, but not always, driven by the fear that the framework itself might be wrong.

This phenomenon is not exclusive to religious and political groups—scientists and engineers are equally susceptible to it and must especially guard against it or risk losing objectivity.

In the debate about evolution mentioned in Colwell's article, for example, these professionals are obligated to recognize any scientific or mathematical objections to the theory even if they don't fit without the current framework. Declaring the debate to be closed when there are outstanding theoretical questions that might conceivably alter the framework is not science but rather another form of dogma.

Aside from the question of whether the universe has purpose, I would suggest that overconfidence in the mainstream framework at this point might cross over into arrogant territory and even stifle original thinking on the matter.



All radical breakthroughs require alterations to core assumptions. Intellectual honesty requires us to be aware of our frames of reference, to recognize that all such frameworks are tainted with preconceived notions to some extent, and to be willing to reconsider all of it when new information comes to light. That new information might support the existing frameworks, or it might challenge them, but the exercise eventually brings us closer to the truth.

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## THE TURNING OF THE WHEEL

Regarding the Neville Holmes column about virtualization in *Computer's* July issue (The Profession, pp. 100, 98-99), it is actually quite difficult to describe the technical distinctions between a "true" virtual machine, a "hybrid VM," an emulator, an interpreter, and a "pure" simulator, in terms that a user would care about. The differences are very real, but they often are not significant to the consumer of the service.

Over the years I have used, helped create, and exploited all of the different breeds. As was true with the evolution of CP-40 -> CP-67 -> VM/370 -> VM/XA, the machines are sometimes varying aspects of the same underlying system. The current taxonomy is flawed, certainly, but perhaps there are few of us left that have the benefit of the history firsthand.

My first encounter with a time-sharing or virtual system was during the summer of 1966 in New York City, using a terminal connected to the M44/44X system at IBM Yorktown Research. My next encounter came during the fall of the same year, when

I wheedled my way into the MIT Computation Center as a freshman and worked as a part-time user-support consultant for CTSS and IBSYS.

Summer 1967 found me spending 60 or so hours a week as a system programmer for the MIT S/360-65 and S/360-40 machines, bringing up ASP 1.0. In the fall of 1968, I had a part-time job at the IBM Cambridge Scientific Center, the start of almost eight years of VM work.

After IBM moved VM to New York in 1976, I spent more than 20 years working in data communications. I was pleased—if not too surprised—to become a daily user of VMWare 1.0 in the fall of 1999. The small group I joined was doing Linux-based development in a larger company at which the IT was built around Windows NT and Lotus Notes, so my desktop ran NT in a VMWare virtual machine under Linux (RedHat 5.2).

Five companies later, I find myself doing exotic Linux kernel work to exploit multiprocessor systems and multicore processors for high-bandwidth IP network equipment. The new chips we are planning to use are embodied as an SDK and companion simulator/emulator, as a matter of course.

One of the bread-and-butter uses for virtualization is still concurrent development of hardware and software—just as it was back in 1970.

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## SCIENCE FAIRS

Reading Bob Colwell's column about science fairs (At Random, "Judging Science Fairs," July 2005, pp. 6-9) brought back some old memories.

In the late 1950s, my science fair project was an acoustic ring gyroscope with no moving parts that used the same principles of operation that a fiber-optic strap-down laser gyro uses. However, I conceived, designed, and built the gyroscope by myself as a teenager for the Boston Science Fair, long before there were any lasers.

My gyro consisted of a roll of plastic tubing with some piezoelectric earphone transducers at both ends. One transducer was connected to the output of an audio signal generator and the other to the input of an audio amplifier. The electronics consisted of vacuum-tube circuitry that I designed and built. It detected and amplified the phase between the transmitted and received acoustic signal that had traveled through the coiled air-column inside the tube. An adjustment was provided to zero the phase detector's output.

The gyro was so sensitive that it could detect the Earth's rotation. If I zeroed the phase detector with the coiled tubing laying on a table, then turned it over so the sound direction was reversed, the microammeter indicator was no longer zeroed. I found that if I zeroed the detector with the angle of the coil equal to the latitude of Boston, it would be zeroed regardless of the sound direction.

My high school physics teacher was so excited that he arranged for us to take a trip to Sperry, the gyroscope manufacturer, on Long Island. We thought they would be so impressed that they would offer me a scholarship and a job.

When I demonstrated my gyroscope, I was asked about the problem with the speed of sound being dependent upon temperature. Surely, this would destroy my invention's utility. Thinking on my feet, I responded that configuring two coils as a bridge would resolve the temperature problem.

I thought it was a successful trip until my teacher and I were served with a "declaratory judgment and cease and desist order" from a federal judge in New York. It seems that I had stumbled into some secret work that the government and Sperry had been doing for ICBM control. Perhaps they were inventing a similar strap-down gyro. I don't know. Anyway, I was no longer

allowed to discuss or even think about my gyroscope.

With the Boston Science Fair only two weeks away, I needed a new project, so I hastily threw together a ham radio antenna and a contraption to measure and plot its directivity. Anyway, I was a winner, and I went on to the state science fair held in Westborough.

The winner of that fair was some politician's daughter with her butterfly collection.

There are important lessons to be learned, the most important being that, regardless of the significance of invention, the butterfly collection must win.

Science fairs are a way of preparing a student for the "real world." Colwell's attempt to purify one might do more harm than good.

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