



seem to have so little to say?

I enjoy a rubber teapot as much as the next guy — more than the next guy — but at this late point, aren't these techie five-finger exercises becoming slightly embarrassing? If Fuseli and Piranesi had had Kai's Power Tools, humankind might never have recovered from the experience. Can it be that these old-fashioned analog geezers simply took themselves seriously in a way that modern computer graphics people somehow lack the nerve to do? Well, how come? And what should be done about that?

Bruce Sterling is a science fiction writer and journalist and can be reached at bruce_sterling@well.com.

Artists and the Art of the Luthier

Bill Buxton

Alias|Wavefront, Inc.

Silicon Graphics, Inc.

The old adage is, "frustration is the mother of invention." For me, it certainly is true. As a professional musician in the early 1970s, I was active in trying to do live performance using electroacoustic instruments. In one sense, the challenge was to extend the nature of "performance" beyond the ultimate creative act of pushing the "play" button on a tape recorder in the concert hall which was the status quo of the day.

I had some novel notion that computer-based "instruments" could be worthy of the name (and hence capable of improvisation, worthy of practice and sensitive to subtle nuances of the performer's skill). This brings me back to frustration and invention. For me, it was more efficient to learn digital electronics and programming in order to design and implement my own instrument rather than learn to struggle (much less play) on what was commercially available. (Of course this equation was facilitated by the considerable help of then students and now giants of computer graphics, Bill Reeves, Tom Duff and Rob Pike.)

This exercise turned out to be one of those life-altering decisions. Not only did I end up with one of the greatest electronic performance systems ever (and a bunch of new friends), I ended up learning a lot about design for the artist, since the system that we developed was used and influenced by musicians from around the world [1, 2, 3, 4]. I also discovered that in the grand scheme of things, there are three levels of design: standard spec, military spec and artist spec. Most significantly, I learned that the third, artist spec, was the hardest (and most important). If you could nail it, then everything else was easy.

After my work with artists, my research

career at the University of Toronto (UoT) and Xerox PARC was relatively simple.

Well, sort of. Every once in awhile, artists resurfaced and interrupted my otherwise tranquil life as a researcher and academic. One prototypical example occurred in 1987 when Alain Fournier and I were co-directors of the UoT graphics lab. Having implemented what we thought was a significantly new airbrush into a paint program, we invited an artist from the CBC, Peter Softley, in to tell us how great we were. Tell us he did. In a few choice words (not suitable for reproduction is such an august ACM publication), he made it clear that it was obvious that neither we — nor anyone else who had implemented an airbrush — had ever seen one, much less used one. A key point, among others, was that nobody ever uses an airbrush without a frisket, or stencil, in the other hand. The one-handed wonders that we and everyone else were producing, were completely incapable of capturing the essence of the art.

The result of Peter's visit was that he took our whole lab to his studio for an airbrush lesson. What we really got was a lesson (a useful euphemism for "kick in the ass") to reaffirm the importance of involving the artist (a. k. a. user, customer — but all too often "victim") in the design process. But the reality is that despite Peter's efforts, it has taken me 10 years to be able to finally bring an airbrush to market that even begins to be worthy of the monicker.

What I knew for myself in my music system, and Peter so delicately reminded me in the domain of paint programs, was that the 10 years that this has taken are nothing special — at least when contrasted to the years that the artists themselves have invested in developing their unique skills. While the essence of artists are reflected in their work, it is rooted in skill — skill which is hard earned, and therefore worthy of respect by the instrument builder, or "luthier." But it is precisely these same skills which are so poorly captured by most computer-based tools. I maintain that the skills (and therefore needs) of the artist are different from those of, say, an accountant. Yet, based on the tools used, when I walk through Disney Feature Animation, for example, I can hardly tell if I am in the accounting or character animation department.

For me, where the proverbial rubber meets the road in all of this is at the level of the input/output transducers that provide the physical interface that captures the artist's gesture in a form that can be understood by the technology. This is where I feel that the greatest potential and missed opportunity lies.

The status quo in the CG world is the "good old" graphical user interface, characterized by its windows, icons, mouse, pointing (WIMP) paradigm. But a mouse is like a bar of

soap, and the only time it's appropriate to draw with a bar of soap is Halloween. So where does this leave the artist the rest of the time? The issue here is one of priorities and relative economics.

Let's look at a couple more conventional "technologies." In contrast to a mouse, if I were to ask you how much does the bow of the first violinist of the New York Philharmonic cost, what would you answer? (Remember, I'm speaking about the bow, not the violin.) The answer, equally true for the first chair of almost any good symphony, is about the cost of an entire SGI workstation. Likewise, if you ask what a full set of top of the line sable water colour brushes costs, the answer is about the same as the cost of a top of the line Macintosh computer.

Now for me, I couldn't tell the difference between the bow of the top professional compared to a beginner's, any more than I could tell the difference between a good sable brush and the brush that came with the \$2.95 watercolor set that I had in grade school. But then, I'm neither a violinist nor a watercolor artist. That is not the point. Because of the huge investment in skill that these artists have made, and the potential that lies behind this skill, these artists deserve tools worthy of their investment. My claim is that, for the most part, artists have been largely short-changed by the computer industry.

In my view, it is time for this to change. The one-size-fits-all general purpose GUI that has dominated the industry is simply not worthy of the latent talent that might otherwise be manifested through the tools that we create. The tools must begin to reflect both the diversity and attention to quality that we see in more conventional media, such as the symphony orchestra or the tools found at an art college. My frustration is that it has taken so long for this to come about. But this is matched by my optimism that things are about to change. If we do it right, and pay attention to the Peter Softleys of the world, we might even get it right.

References

1. Buxton, W., A. Fogels, G. Fedorkow, L. Sasakian and K. C. Smith. "An Introduction to the SSSP Digital Synthesizer." *Computer Music Journal* (4), pp. 28-38, 1978.
2. Buxton, W., S. Patel, W. Reeves and R. Baecker. "Objed and the Design of Timbral Resources." *Computer Music Journal* 6(2), pp. 32-44, 1982.
3. Buxton, W., W. Reeves, G. Fedorkow, K. C. Smith and R. Baecker. "A Microcomputer-Based Conducting System." *Computer Music Journal* 4(1), pp. 8-21, 1980.
4. Buxton, W., R. Sniderman, W. Reeves, S. Patel and R. Baecker. "The Evolution of the SSSP Score Editing Tools." *Computer Music Journal* 3(4), pp. 14-25, 1979.



Bill Buxton's original training and career was in music performance and composition. He is currently Head — User Interface Research at Alias|Wavefront, Inc. of Toronto, and Chief Engineer at Silicon Graphics, Inc., Mountain View. He is also a Professor in the Department of Computer Science at the University of Toronto, where he directs the Input Research Group. His other main preoccupation is human-horse interaction.

Buxton can be contacted at buxton@aw.sgi.com or http://www.dgp.toronto.edu/people/Bill_Buxton/billbuxton.html.

Art or Virtual Cinema?

Mario Cavalli

Director, Pizazz Pictures

Typically in the popular press and television, one of the most frequently asked questions surrounding computer graphics at the moment goes something like this: "Will virtual actors ever replace real actors?"

Chances are that somewhere in Hollywood there is a producer with an interest bordering on necrophilia, intent on resurrecting, say, Marilyn Monroe for a new movie. It's not surprising, therefore, to find a little Luddite paranoia surrounding this new box of tricks.

In any case, it has already happened. There must already be a dozen or so movies where prominent cast members, be they dinosaurs, dragons, ghosts or twisters, have either been unavailable in their corporeal forms or not yet signed with a major Hollywood agent, thus allowing computer graphics its opportunity to step out of the wings and into the limelight.

One of the ironies here is that the greater the technical capability of CG and consequently, its viability as a medium of artistic expression in its own right, the greater its obsession with verisimilitude, ultimately resulting in the sort of crass assumptions contained in questions of this sort.

Most of the recent examples from the movie world do not demonstrate anything really unique to the CG medium but simply provide the film industry with arguably, better, faster or cheaper ways of generating the special effects that a decade ago would have been produced by optical or analogue means.

What is perfectly illustrated, however, is the often repeated phenomenon of a new medium aspiring to the condition of the form which preceded it. In the same way as early photography aspired to the art and status of painting and early cinema took its cue from the theatre, so with CG we have invented a new way of producing cinema, or rather, virtual cinema.

The process of discovering the unique artistic voice of a new medium can take a surprisingly long time. In the case of the cinema, the leap from simple, moving photography,

from a fixed camera position and of largely uncut footage, to the introduction of film editing, of shots taken from different camera angles for dramatic and narrative effect, took about eight years with Edwin S. Porter's *The Great Train Robbery*, 1903. It was another 12 years before D. W. Griffiths used this technique on the mass audience with *The Birth of a Nation* in 1915 and yet another 10 before Sergei Eisenstein articulated this specific and unique feature of cinema in his own films, *Battleship Potemkin*, 1925 and *October*, 1928. His book, *The Film Sense* (one of the earliest film textbooks) was not published until 1943.

We may currently be celebrating the centenary of the cinema but film makers even now use archaic theatrical expressions: emergent stars (or new media) enter the "limelight." Some will, on rare occasions, attempt to "upstage" one another and the film scripts they perform are still written to a "three act" structure, surely implying the change of scenery as the curtain draws across the proscenium. This is an endearing if entirely redundant practice in most of our cinemas even today!

The important point here is that if all of the milestones in the artistic development of the cinema took place during the first 30 years of its existence, all of them also occurred before the introduction of its most significant technological innovations: the coming of sound in 1927 with *The Jazz Singer*, the first colour feature film, *Becky Sharp* in 1935 and the introduction of stereo sound in 1941 with *Fantasia*.

In the case of CG, the process has been precisely inverted. The speed of technological development has been bewilderingly fast, outstripping its implementation by the artistic community, which for the most part, has been left standing slack jawed in the dust.

The initial cost of hardware and software is, of course, one factor which favours the entertainment industry over the artist. The steep learning curve required to master these new tools is another, but, on the whole, access to new technology has not traditionally been an inhibiting factor for artists interested in the expressive potential of new technology. Quite the opposite, in fact, for patronage, from religious painting to television commercial has long since stimulated the developments of new methods and technologies, just as it has stimulated new ways of thinking about them.

More significantly, it is the very protean nature of CG which tends to confuse the issue. Here is a medium with which we can create practically any image, in 3D, in motion and with interactivity: virtual reality or fantasy, with knobs on. Where on earth do we begin?

Well, the entertainment industry, which this year (1996) overtook the aerospace industry as the United States' biggest exporter, needs little prompting. In addition

to movies, it has found better, cheaper and faster ways of making arcade games, theme park rides and motion simulators. Medical and other scientific disciplines have also extended their capabilities by the use of CG developments such as "augmented reality" or the superimposition of CG images on to the real world; a chilling reminder that military applications have been responsible for much of the research and development work in this area.

But what of the artist? What are the unique characteristics of the medium which make it uniquely attractive to the creative mind? These are much harder to identify, since throughout its evolution, CG has been designed to replicate and expand other existing technologies.

The answer may ultimately have something to do with the unexpected combination of methods and technologies. William Latham's work, for instance, uses digital biological processes to "sculpt" organically evolving and mutating forms. My own short "film" (needless to say, the use of acetate and emulsion played no part in its production) of Ravel's *Bolero* employs motion capture technology to animate abstract and semi-abstract human figures with genuinely human dance movement. Unlike the now orthodox Hollywood application of CG, these are examples of creative ideas which would be impossible to produce by other means.

But another, perhaps ultimately more intriguing and exciting prospect, is that afforded by the "interactive" potential of CG. I am not concerned here with the supposed "interactivity" of CD-ROM, which in most cases is little more interactive than its print equivalents and much less portable, or with the much hyped World Wide Web, for all its fantastic range of resources. I refer instead to kind of interactivity which presents the potential for perhaps the most radical change in our attitude to the act of creativity itself: no longer the finite product of one individual or group for the passive appreciation of others but an ongoing and collaborative endeavour between the original "creator" and ultimate "audience."

The first signs of this artistic revolution are appearing in the unlikeliest of places, such as the "screensaver" modules which allow the user to define certain parameters for the creation of patterns and pictures. Simple to use yet utterly idiosyncratic in result. This idea has been taken one commercial step further with the introduction of software designed specifically to produce synthetic landscapes. Who can claim to be the true "author" of a Bryce landscape? The end user or the development team at MetaTools or Kai Krause for dreaming the thing up in the first place? They are surely collaborative works, though their authors may be entirely unknown to each other.