In Memoriam: Jane Wilhelms

Brian A. Barsky

I had the pleasure of working with Jane Wilhelms, who was one of my doctoral students from 1981 to 1985. One of the intellectual delights of working with Jane was that she had an unusual educational background. I recall vividly that, instead of a predictable background in computer science, she brought an education in zoology and biology. Her undergraduate zoology degree was from the University of Wisconsin, Madison, and she had completed an MA in biology at Stanford. She had taught anatomy and physiology at the junior college level.

In the early 1980s, we were engaged in a project investigating the incorporation of antialiasing in various types of visibility algorithms (which we referred to by the now dated term "hidden surface" algorithm). It was an exciting time as we explored these nascent techniques. During these early days, we were collaborating with the newly formed Sprockets Division of Industrial Light and Magic at LucasFilm, headed by Ed Catmull and Alvy Ray Smith. It was this group that became Pixar when purchased in 1986 by Apple Computer founder Steve Jobs. Jane worked part time at Sprockets while pursuing her PhD at Berkeley. As part of her Master's work at Berkeley, Jane developed a visibility algorithm with antialiasing.

I recall discussions with Jane on the path to shaping a dissertation topic for her. With her interest in anatomy and zoology, it was a natural evolution for her to work on dynamic analysis for animating articulated (linked) bodies. Dynamic analysis predicts motion by analyzing the effect of forces and torques on mass, unlike kinematics, where positions, velocities, and accelerations are given without considering the forces and torques producing motion.

Kinematically specifying realistic motion can be difficult, particularly in cases where the body is moving fast, in complex patterns, or with great freedom. In such cases, animation based on dynamic analysis may be preferable. Animation using dynamic analysis is also useful in the design and control of robots and other mechanical manipulators and for analyzing the movement of humans and animals in biomechanics and sports. At the time, our simulations of the motion of articulated bodies had to compute overnight, but, of course, the concepts were sound and now form the basis of real-time simulations. We presented our results in May 1985 at the Graphics Interface conference in Montreal and Jane completed her dissertation on the topic that summer.

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Upon completion of her PhD in 1985, Jane joined the Computer and Information Science faculty at the University of California, Santa Cruz. Her research expanded from her work in physical simulation to topics in scientific visualization, often in collaboration with Allen Van Gelder, in the same department. One of her more influential articles was the 1992 *ACM Transactions on Graphics* paper, "Octrees For Faster Isosurface Generation." This widely cited paper introduced the "branch on need" strategy for octree decomposition, which was adopted by other researchers in a variety of applications other than isosurfaces. A theme for much of her research in this area was achieving interactive rates for visualizing large data sets, often through direct volume rendering. Several of her students did their thesis research on this problem.

In 1997, Jane presented a paper at SIGGRAPH related to her earlier work. In her presentation entitled "Anatomically Based Modeling," Jane introduced the technique of modeling humans and animals beginning with an articulated skeleton to which deformable major muscles are attached and, finally, a deformable skin surface is attached over those. The muscle model was central to producing realistic effects. Although simplified enough to run in real time, it included "anatomically correct" aspects, such as multiple origins and insertions, irregular cross-sections, and preservation of volume when the length changed. Anatomically-based modeling quickly became an active research area and this paper is widely cited.

In her own research group, the model was enhanced with elasticity for the skin, fur for animals, realistic 3D joint limits, and transformations between different mammalian species or subspecies. Several of her students did their thesis research on various developments of anatomically-based models. Later papers explored capturing motion from a video sequence and transferring it to such models of humans and horses. The technique is beginning to appear in commercial software.

It is perhaps somewhat poignant to note that Jane's final scientific contribution occurred as she found a way to bring in her love of horses to the computer graphics field. Moreover, this brought her full circle in her computer graphics career because her primary collaborator in this work, Maryann Simmons, had just completed her PhD at Berkeley before joining Jane as a postdoctoral researcher in 2002. Maryann became interested in Jane's research on anatomically-based modeling after seeing preliminary results from the "Equus" project, a research effort geared at developing 3D virtual horse models and animations. Together with Allen Van Gelder, they addressed the problem of transforming an anatomical model of one breed of horse, including the skin, into models for differently shaped breeds, based on measurements of key anatomical

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features. The results, including a new skinning algorithm developed during the project, appeared in the paper "Model-Based Reconstruction for Creature Animation," which was presented at the 2002 Symposium on Computer Animation.

Maryann recounts the story of when she first went to Santa Cruz for her first meeting with Jane:

> Jane arrived slightly late for our initial meeting, explaining that she had stayed behind with the veterinarian to tend to a sick horse. It was at that point I knew for certain that it was going to be a great experience. It was a rare opportunity to work on a project with someone who contributed so much to the field of animation and modeling, while bringing a deep expertise in biology to the problem, and a down-to-earth love for horses as well.

I am sure that I speak for all who knew Jane when I say that she professionally enriched the computer graphics community and personally touched the lives of those who knew her.

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Donations may be made in Jane Wilhelms' memory to the United Pegasus Foundation, a California horse rescue organization (http://www.unitedpegasus.com/).