From University Lab to Movie Screen and Back Again: How Does Research Change Production Tools, and How Do Production Needs Influence Academic Research?

Moderator
Daniel Goldman (University of Washington)

Panelists
Tony DeRose (Pixar Animation Studios)
Andrew Hendrickson (PDI/DreamWorks)
Barbara Mones (University of Washington)
Paul Salvini (Side Effects Software Inc.)
Steve Sullivan (Industrial Light & Magic)

How and when do academic research ideas make their way into feature animation and visual effects production facilities? What kinds of graphics research ideas have made good production tools, and how are they transformed by practical experience and needs? What pressing production issues should be considered in academic circles? To what extent is the industry using standardized tools, which might be slowing adoption of new techniques? How are intellectual property issues resolved? How could academia and industry work together more closely to bridge the gaps? Panelists from academia and production explore these and other issues in this vital relationship.

Position Statement: Daniel Goldman

Although the production of computer animation is frequently transformed by developments in academia, few companies in the industry have any formal relationship with academic institutions. In this panel, I hope to sample the state of the relationship between computer graphics academia and industry, and to explore ways in which this relationship might evolve in the future. Each of our panelists will present their institution's model for technology transfer, and discuss its successes and failures.

Biographic Sketch: Daniel Goldman

Dan Goldman began his career in internships at Industrial Light and Magic and Digital Domain while an undergraduate at Stanford University. After graduating in 1995 with Bachelor's and Master's degrees in Computer Science, he returned to work at ILM in a number of roles as a technical director, computer graphics supervisor, software engineer and researcher until 2004. He has recently jumped back to academia as a PhD student in computer graphics at the University of Washington, and continues to work with industry as a freelance consultant.

Position Statement: Tony DeRose

I've been on both sides of the academic research/production fence. I've seen first hand just about everything. From neat new academic results that fit right into production, to results that at first appear promising but ultimately fail to deliver, to results that are interesting from an academic perspective but are not appropriate for production. Going the other way, I've seen advances in production techniques inspire new threads of academic research. One thing has become clear: the transfer of technology from the research lab into production is at least as hard as the invention of the technology.

For a technology to transfer smoothly, a number of conditions must exist, including:

- The technology is most easily adopted if it corresponds to an existing extensible part of the production pipeline. Examples include programmable shaders that implement local lighting models, new kinds of particle systems, and ray-object acceleration methods.

- The technology should be "directable", meaning that it should be possible to modify the results produced by the technology to respond to the feedback of the director. Film making is a creative process that only loosely mimics reality. Fully automatic methods that adhere strictly to physics are unlikely to be adopted.

- The technology should be controllable. There should not be a large number of knobs that need to be set by highly technical users.

- Most importantly, the technology should enhance the artistry of the users, not attempt to replace it. Classic counter examples are methods that attempt to replace the motion created by skilled animators using automated techniques that take only high level guidance. While such methods may be appropriate for providing initial motion, it is the job of the animator to add the subtle emotion. It is the subtlety that sells an acting performance, and animators are fundamentally actors.

Biographic Sketch: Tony DeRose

Tony DeRose, Senior Scientist, Pixar Animation Studios. I've been on both sides of the academic/production fence. I started my career as a professor at the University of Washington, where I co-founded the graphics lab there in 1985 with Prof. Ken Sloan. After ten years on the faculty at UW I joined Pixar, where I'm now the lead of the research group.

Position Statement: Barbara Mones

The ability to integrate current research and research tools into the production pipeline for an animated film can be essential to the impact of the story and, as a result, immeasurably enhance the succes of the film. Wonderful stories tend to be unique in style and structure which makes it

difficult to develop research that can be used for multiple productions and therefore avoid having to develop specific research to support specialized needs.

In academic settings, however, research does not tend to be tied to any particular production. Researchers often have more freedom to select an area that interests them and follow their own vision unrelated to the needs of a commercial story or film.

In the animation industry however, research projects are developed specifically to support the look and feel, or other effect that originates from the story and film under development may not be broad in scope.
As a result, there can be some real and perceived limitations that researchers in industry experience (less freedom to pursue their area of interest) and different limitations that academic researchers might face (having nowhere to test the practical applications of their work). Both problems can affect the quality of the research, researcher and ultimately, the integration of the research into the animation production pipeline.

One solution to this problem of limitations, is to broaden options for researchers in industry allowing them to pursue broader research avenues that are not as limited to the specific needs of the project du jour. Another option is to design a hybrid testing ground inside an academic institution where those with production experience can test out academic research, provide feedback and facilitate a dynamic and productive dialog that improves the quality of the work produced. I would like to discuss these options and present suggestions about how to maximize their potential and impact.

Biographic Sketch: Barbara Mones

I am on the faculty of Computer Science & Engineering at the University of Washington. I have a background in sculpture, computer graphics, digital animation, animation production (both in industry and academia) and have worked in both art and computer science environments. Most importantly, an important mission of mine here at the University of Washington is to facilitate the integration of the academic research in graphics and animation into the production of our short animated films. Interdisciplinary teams of students have worked to collaboratively create these films annually for the past eight years and the academic research has been showcased to the benefit of all involved. I teach in a setting that has been designed to be a good option for a hybrid mixture of industry, academic research and animation production environments. This is a unique opportunity as the research here is of an unusually high quality and therefore the potential to fulfill this mission is an inspiration and one that remains within reach. Examples exist already that allow the production students to showcase the animation research done here. Because of this specific mission and the supportive environment in this particular department for this idea, there's some terrific work that has been able to evolve. In addition, there are other academic institutions that have pursued similar approaches with very successful outcomes. It would be useful at this point in time to share both the successes and challenges related to these approaches so that we can all benefit from the discussion.

Position Statement: Paul Salvini

As someone with one foot in industry and the other in academia, it is my position that academic institutions should not work more closely with production studios to solve pressing (short term) production issues.

Academic institutions have two important duties: to educate and to conduct research. Sadly, many academic institutions have drifted away from these duties in the quest for better funding. As a consequence, academics have less time for teaching, supervising, researching, and publishing.

There are three key players in the production world: 1) production facilities that do the work, 2) tool developers that equip the production facilities, and 3) academic institutions that manage and enhance our body of knowledge. I would argue that each is best equipped to focus its research on problems at a slightly different level.

At one end of the spectrum are production facilities that understand today's needs and are required to find solutions to short-term production challenges. They generally do not have the time or mandate to formalize their research or to communicate their findings.

At the other end we have academic institutions that have the ability to tackle larger problems over longer time frames and leverage a wide body of research from related disciplines. They have a mandate to educate, conduct research, and communicate results.

In the middle we have the tool developers (some living within large production facilities). Their goal is to provide innovative and flexible tools that can solve any number of production challenges without significant customization. It is at this level that I feel we have the best chance to bridge academic research and production needs.

Specific examples of academic research leading to successful production implementations can be found throughout our software. In most cases, however, additional research was necessary to bridge the gap from academia to production.

Biographic Sketch: Paul Salvini

With a career that straddles both business and academia, Dr. Paul Salvini understands first-hand the challenges facing academic researchers looking to collaborate with industrial partners.

As Chief Technology Officer and Vice President of Canadian Operations at Side Effects Software, he leads a world class Research and Development team in the development of Houdini: a family of 3D animation products for feature animation and visual effects. In its commitment to the advancement of the art and science of computer graphics, the company collaborates with both production facilities and university researchers.

As Adjunct Professor of Engineering and Applied Science at the University of Toronto, he conducts research in the area of complex systems simulation. Prior to his appointment at the University of Toronto, he served for over ten years as an Adjunct Professor in the School of Computer Science at

Ryerson University and as a member of their external Advisory Board.

Dr. Salvini holds an Honours Bachelor of Mathematics (BMath) degree in Computer Science from the University of Waterloo, Master of Applied Science (MASc) and Doctor of Philosophy (PhD) degrees in Engineering from the University of Toronto, and a Masters of Business Administration (MBA) degree from the Rotman School of Management.