Princeton University

Honors Faculty Members Receiving Emeritus Status

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The biographical sketches were written by staff and colleagues in the departments of those honored.

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Faculty Members Honored in 2019
for Receiving Emeritus Status

THOMAS FUNKHOUSER

Thomas Funkhouser, the David M. Siegel ’83 Professor in Computer Science, is transferring to emeritus status after more than two decades on the Princeton faculty. Although Tom’s research interest did not begin in computer science, he ultimately entered the field after— as he tells it— spending a long, dreary summer doing research on barnacles. He earned his Ph.D. from the University of California-Berkeley in 1993, and joined Princeton in 1998 after four years working as a research scientist at Bell Laboratories. In the years since, he has become one of the world’s foremost experts in computer graphics, pioneering the use of computers to analyze, understand, and manipulate 3-D shape.

Early in his career, Tom laid the groundwork for multiple subfields of computer graphics including the design of systems for multi-user virtual environments— which form the basis of today’s massive multiplayer online games— as well as aspects of the now re-emergent field of virtual reality. He was a core contributor to the UC-Berkeley “Walkthru” project, one of the first and most noteworthy interactive virtual walk-throughs of a large architectural space. Tom pioneered the use of a server architecture capable of handling many independent participants cooperating in the same virtual environment. He also worked on the fundamental problem of visibility— answering the question of how we can efficiently determine which relatively limited part of an extremely complex 3-D scene is visible from a particular vantage point. To support interactive rendering in the days before ubiquitous highly accelerated graphics cards, Tom described how a system could choose an appropriate level of detail for an element of such a scene shown from a distance. His work also bridged the fields of graphics and acoustics, by simulating how both light waves and sound waves propagate in 3-D scenes. This made it possible for virtual environments to not only look right, but also sound right.

Tom also created bridges between graphics and other disciplines. He worked with bioinformaticians to develop algorithms that predict the active sites and molecular functions of proteins from their 3-D structures. He assisted archaeologists in automating the reconstruction of fractured frescoes by providing scanning, matching, and assembly algorithms. He assisted paleontologists to reason about phylogeny by providing algorithms to measure the morphological similarity between scanned fossils. Finally, he helped artists describe how lines in drawings made by people relate to underlying geometric properties of the artist's subject.

It is Tom's work on shape analysis, however, that has had the greatest impact in the research community. In 2001, even before Google became the dominant web "search engine" for textual queries, Tom and his students launched a wave of research with their work on a search engine for 3-D shapes represented in the computer. Their work allowed someone to search in a huge database of 3-D models for something shaped like a chair, by providing an example chair model or even just a sketch of a chair. This work expanded to analyzing shapes for symmetry, for decompositions into parts, and for "surface saliency," that is, which parts of a shape are most important for recognizing and understanding it. Tom's group went on to study "shape correspondence"—for example, the idea that the tip of the left paw of a cat in a particular pose would be analogous to the equivalent part of a dog in a different pose— and showed how the study of relationships between shapes more generally could be bootstrapped with only a few such correspondences. They also studied how a computer could make predictions of how humans would interact with a given 3-D shape, for example where someone might grab an object. Most recently, Tom and his students have been exploring how the machine learning revolution can be extended to 3-D shapes: how deep neural networks can be trained to understand both the details and the overall structure of 3-D environments, including how to predict what might be hidden in parts of the scene that cannot be observed directly.

Tom has been inducted as a fellow of the Association for Computing Machinery (ACM) as well as the ACM SIGGRAPH Academy, and has received numerous honors and awards including the ACM SIGGRAPH Computer Graphics Achievement Award, an Alfred P. Sloan Fellowship, and the National Science Foundation CAREER Award. Over the course of his two decades at Princeton, Tom received the Excellence in Teaching award twice from the undergraduate and graduate Engineering Councils, advised 17 Ph.D. students, and served as the director of graduate studies in computer science.