COMPUTER HISTORY PROJECT

COMPUTER GRAPHICS CENTER OF EXCELLENCE

establish a computer science research program at University of and joints in the pavement formed a three-dimensional reference Utah. Evans was immediately awarded a large ARPA grant from system. The points and polygons were rendered using hardwa Bob Taylor, then Director of the ARPA IPTO office, to create a developed by 1970 Utah Ph.D. Gary Watkins to imprint shaded center of excellence in computer graphics. Evans believed that images onto a direct film recorder. Also in 1972, Ed Catmull and small, interactive computers should be developed to augment Fred Parke, both students of Sutherland, made a video human creativity, and he planned to use the ARPA award to illustrating the process of modeling Catmull's left hand and its pursue this line of research. Leveraging the multi-million dollar use in animation. Catmull made a plaster mold, to which he then funding from ARPA, Evans was able to harness the absolute added points and polygons in a similar way. Catmull received h

The powerful resources at Utah were instrumental in attracting earliest fully-rendered computer animations. the very best faculty, students and collaborators to work with Evans on his vision. In recruiting Ivan Sutherland, David EvansCOMPUTER GAMES planned both his department and a company (Evans and Utah students also developed early computer games. Nolan Sutherland, founded in 1968) that could develop interactive Bushnell, who received his undergraduate degree from Utah in graphics workstations. Evans and Sutherland scoured the 1968, developed the widely-used Pong game and went on to research community to attract the best talent among the skill sets found Atari in 1972 and Chuck E. Cheese's Pizza Time Theater required to build these systems. From MIT, they recruited Chain in 1977. Many of the graphics algorithms are widely use engineering and signal/image processing talent, including in computer games. Today at Utah, undergraduate and graduate faculty Tom Stockham and Chuck Seitz, and Ph.D. students programs in Electronic Arts and Engineering, joint ventures Donald Oestreicher and Al Davis. From Ecole Polytechnique between computer science and film, are producing the next and other universities in France, they attracted the mathematical generation of games designers. talent of students Robert Mahl, Henri Gouraud, Patrick Baudelaire, and Bui-Tuong Phong.

program made seminal contributions to rendering, shading, Graphics and Visualization Center, an NSF Science and animation, visualization and virtual reality (notably the work of Technology Center. The focus of the center was to conduct Warnock in 1969, Gouraud in 1971, Donald Vickers in 1972, graphics research in modeling, rendering, user interfaces and Phong in 1973, Ed Catmull and Fred Parke in 1974, Henry Fuchs high-performance architectures. The research was driven by tw and Martin Newell in 1975, Frank Crow in 1976, Jim Blinn in application areas: scientific visualization and telecollaboration in 1978, Jim Kajiya in 1979, and many others). Additional graphics virtual environments. Utah's involvement, led by Rich faculty hired during this time included computer artist Ron Riesenfeld (faculty from 1972 to present) and Elaine Cohen Resch (1970-1979) and Rich Riesenfeld, an expert in (faculty since 1984), included the mathematics of surfaces, computer-aided geometric design (1972-present).

EARLY GRAPHICS AND VISUALIZATION IMAGES

In 1968, the equipment needed to produce an image representation was significant: a mainframe Univac performed SCIENTIFIC COMPUTING AND the computations to produce the image, it sent its result to a **IMAGING INSTITUTE (SCI)** PDP-8, which through analog output lines sent the image to a The STC's application focus on scientific visualization gave rise Tektronix oscilloscope to draw lines. A camera then recorded the to Utah's subsequent strength in this area. Chris Johnson joined image, without the image ever being displayed on a screen. Color the Utah faculty in 1992 and collaborated with the STC images required several photos, each with a different colored researchers. Johnson in partnership with Rob McLeod, filter. John Warnock, who received his Ph.D. in 1969, developed research assistant professor in the Utah medical school, ha the first scientific visualizations using this approach. After Utah, already been conducting research on biomedical computing and Warnock moved to Evans and Sutherland, Xerox PARC, and visualization. With McLeod and a group of students, Johnson then co-founded Adobe in 1982.

NEWELL AND THE UTAH TEAPOT

graphics. It was designed by Martin Newell, inspired by an now home to more than 200 faculty, staff, and students. The actual Melita teapot he purchased from a department store in overarching research objective is to conduct application-driven Salt Lake City. Newell was a student of Evans, graduating in research in the creation of new scientific computing techniques, 1975, and then a member of the faculty from 1975-1977. tools, and systems. SCI Institute research interests generally fac Originally the teapot was sketched by hand using paper and into the following areas: scientific visualization, scientific pencil. Newell then edited bezier control points on a Tektronix computing and numerics, image processing and analysis, and storage tube. With this information he created a dataset of scientific software environments. mathematical coordinates and a 3-D wire framing. The Utah Teapot was one of the first widely available and photogenic curved-surface 3-D models, an early high-quality virtual object. For this reason, it became a common benchmark model for image synthesis programs.

OTHER MODELING EFFORTS

Utah students modeled other common objects. For his 1971 dissertation, Henri Gouraud developed Gouraud shading, using his wife Sylvie's face as a model. In 1972, Ivan Sutherland challenged his graphics class to choose something iconic to realistically render. The students selected the Volkswagen Beetle—as a symbol of global culture, because it was large enough to measure as a group, and because Ivan's wife, Marsha,

owned one. The students painted points and lines on the surface In 1965, Berkeley professor David Evans returned home to of the Beetle to describe a set of polygons. A volleyball stanchid state-of-the-art in equipment needed to advance this area. Ph.D. in 1974, and went on to found Pixar. The video has recently been added to the National Film register as one of the

GRAPHICS AND VISUALIZATION CENTER

In 1991, Brown University, Caltech, Cornell, University During the era of Evans and Sutherland, graduates of the Utah and University of North California partnered to form the modeling, human-computer interfaces, and design. The research built on Riesenfeld and Cohen's prior work on B-splines, NURBs and the Oslo-algorithm for geometric and shaded rendering computations.

established the Scientific Computing and Imaging (SCI) research group, pronouncing it "ski" as in "ski Utah". SCI continued to grow, becoming a university center in 1997 and a perman The Utah Teapot is arguably the most iconic image in computer interdisciplinary research institute in 2000. The SCI Institute is

> This is the third in a series of three displays on the role of Utah students and faculty in computing history. The others describe high performance networking and storage and high-performance computing.



A special thanks to the J. Willard Marriott Library Special Collections, Artist Anna Campbell Bliss and the Computer History Museum for contributing materials for this display and associated video.





ellence in computer graphics research.

1968. They form Evans and Sutherland that yea build interactive graphics computing systems. Sutherlar

(left) and Evans (right) are shown here in 1969 with the





men in creative activities..."



rendering algorithm that recursively subdivides a scene. develop early virtual reality systems. His student This is an early image from this work.



– David Evans, Presented to the 1967 Conference of Associated

University Bureaus of Business and Economic Research, October 11, 1967.

entific American cover from 1970.



Warnock's early images required this special camera, This is the first published computer-generated images attached to an oscilloscope, which photographed the Newell's teapot. images derived by a mainframe computer. The process took several minutes per image.



pleting his Ph.D. in 1975, Newell joined the facult 5-1977. He is shown here with a student.



"In my own experience, I have seen the capability of computing systems to perform well defined repetitive tasks increase by a factor of greater than one million. At the same time as this great progress has been made, there has been little progress until very recent years in giving computing systems the capability to aid "Almost every influential person in the modern computer-graphics industry either passed through the University of came into contact with it in some way. - Robert Rivlin, The Algorithmic Image, Microsoft Press, 1986. his 1975 Ph.D. dissertation, Bui Tuong-Phong ibed the Phong shading method which introduces Faculty member Ron Resch focused his research o er-generated art. The Vegreville Egg, which in a town in Alberta, Canada, is a three-and-a-half story including Toy Story. He is the winner of several drawn on her face to develop the points and polygons Academy Awards. for the model used in his work. Newell drew this model of his own Melita teapot on graph paper to derive the model.







"A display connected to a digital computer gives us a chance to gain familiarity with concepts not realizable in the physical world. It

"[David Evans] wanted to do this work in graphics, and we got that started. I understood that field well, and moreover, Evans had had some key ideas as to how to do it."

- Ivan Sutherland, "An Interview with Ivan Sutherland," William Aspray, Charles Babbage Institute, May



rendering equation and the notion of a frame buffer, eo output device that drives a video display fro memory buffer containing a complete frame of data. He was a faculty member at Caltech before joining Microsoft, where he is now a Distinguished Engineer. He was awarded the ACM SIGGRAPH Technical Achievement Award in 991, a technical Academy Award in 1997, and the RAPH 2011 Stephen Coons Award.

















"I had ... a wonderful experience in graduate ... And I knew at the time that it was special. It was creative and I suspected that nuch of the rest of the world was not that way. And I left with a couple of goals. One of them was I wanted to be in more environments like I here. The other was the goal of creating a

Ed Catmull, Utah Ph.D. in 1972, Pixar founder, at the University of Utah Commencement, 2012.

"The best solutions 1 99 are always simple.

- Ivan Sutherland, from ACM Turing Award website, written by Robert Burton.