Tosiyasu L. Kunii, 1938–2020

Michael J. Wozny, *Founding Editor-in-Chief of IEEE Computer Graphics and Applications, Professor Emeritus and Former Department Head Electrical, Computer, and Systems Engineering, Rensselaer Polytechnic Institute, Troy, NY, 12180, USA*

Prof. Tosiyasu L. Kunii (1938–2020) passed away on November 3, 2020. He was a longstanding member of the Editorial Board of IEEE Computer Graphics & Applications*, serving for over 21 years from 1982 into 2002 and over the span of six different Editors-in-Chief. His own work was published 18 times over the years in the pages of* IEEE CG&A*, and his contributions to multiple research areas within computer graphics and computing are highly regarded. Among his many accomplishments, he was an IEEE Life Fellow and recipient of the prestigious IEEE Booth Education Award. With more than 50 published books and 500 refereed articles across the major publications and conferences of our field, and with colleagues and former students distributed around the world, his work and legacy will live on.*

Tosiyasu L. Kunii's legacy extends beyond his outstanding research and the students he has mentored. He also achieved exceptional, enduring organizational outcomes as a founder and creator. He was a visionary who was able to embed his technical accomplishments into settings that took on a life of their own and carried his work, and ultimately, his legacy, forward.

Tosi started his professional career as an academic and researcher in Physical Chemistry, basically a scientist. Although he used computation and databases very successfully in his early research, over time he became more attracted to computer science questions. Technical areas such as computer graphics, human–computer interfaces, visualization, networking, and the potential of workstations were in their infancy.

Tosi intuitively recognized that this technical area of computer science was expanding rapidly and offered opportunities for advances in research. One of his long-term goals was to characterize the interrelationships between real world representation of phenomena and its corresponding "virtual" world. (He later used the terms, "cyberworld" and "visual computer.")

On the other hand, he also observed that the Japanese academic community was slow to adopt this evolving information science "discipline" and as a

FIGURE 1. Prof. Kunii as the recipient of "order of the sacred treasure" in 2013.

result produced insufficient numbers of graduates to support the growth of computer science in Japan.

We will see later that these circumstances inspired some of Tosi's major accomplishments.

Tosi was also an achiever. He had the leadership skills and perseverance to make things happen.

In this memorial tribute, I concentrate on three vignettes that indicate the depth and extensiveness of his accomplishments. First, I reflect on the legacy of Tosi's 21 year association with *IEEE CG&A* as a a member of its Editorial Board. After listing his professional appointments, I explore the legacy of his leadership in establishing new technical societies, conferences, and journals. I then marvel at his remarkable legacy of founding a new university focused entirely on Computer Science and Engineering. Embedded in this entire reflection is the extent of his research contributions. His legacy in research, in establishing a new university, and in creating new societies have prevailed, because Tosi constructed them on a robust and reliable foundation.

I am grateful to have known and worked off and on with Tosi over a lifetime. Tosi was a very empathetic person always caring and looking for ways he could help colleagues: either advocating on their behalf or personally arranging side trips to beautiful sights in Japan. I am sure many colleagues can look back and be grateful that their paths crossed with Tosi's path.

LEADERSHIP QUALITIES

Tosi is an internationally respected pioneer and leader in the field of visual computing, computer animation, multimedia, digital media, database management systems, pattern recognition, software engineering, distributed databases, telecommunications, and networking. He was elected, in 1991, to Fellow of IEEE for "Contributions to Visual Computer and Visual Computation," and shortly thereafter in 2000 to Fellow of the Information Processing Society of Japan (IPSJ) for "International Contributions to Pioneering In and Establishing the Discipline of Visual Computing." In addition to other awards, citations and recognitions, and publications, his legacy includes the many graduate students he advised who have achieved technical leadership positions in academia and industry, not only in Japan but also around the world, including the United States, China, Korea, and India.

I will always remember Tosi for his unrelenting dedication and exceptional contributions to *IEEE Computer Graphics and Applications (CG&A)*. He served on the editorial board for 21 years under six Editors-in-Chief. He also served as Associate Editor-in-Chief.

Tosi was on my short list for the editorial board from the very beginning as we launched the first issues in 1981 and 1982. Tosi and I had a common professional goal to attract significant industrial interest

FIGURE 2. His time as a graduate student at the laboratory in the department of Chemistry, the University of Tokyo, around 1963.

to our respective research programs, Tosi getting involved more as a consultant and, in my case, as sponsors of my computer graphics research center at RPI. This in part helped attract him to our fledgling publication. Tosi published 18 articles in the pages of *IEEE CG&A* from 1984 to 2005, comprising a broad range of computer graphics related research areas. He also guest edited nine special issues of *IEEE CG&A*: from "Frontiers in Computer Graphics and Applications: Selections from Intergraphics '83," in 1983 to "Web Graphics" in 2003. A strong believer in the exchange of information, he selected the best papers from top Japanese computer graphics conferences, had them reviewed and revised, then made them available to the broad *IEEE CG&A* readership.

In the final analysis, it is due to excellent visionary colleagues, like Tosi, serving on the editorial board that *IEEE CG&A* quickly established itself as a high-quality publication and continues to be highly regarded today as the technical areas it covers continue to rapidly evolve and expand into new domains.

THE RIGHT STUFF

Tosi's association with *IEEE CG&A* represents but only one dimension of his multifaceted technical interests and accomplishments. He has published more than 50 books and approximately 500 refereed papers. He also obtained five patents during the time he spent in industry. However, it is the high quality and diversity of his work that typifies his impact on the field, rather than just numbers.

Having a very dynamic and inquisitive personality, it is not surprising that he served the world technical

community in many capacities. He served on more than 20 Editorial Boards over various periods; in some cases as the Founding Editor or the main driving force behind their establishment. For example, he was the Founder and President of the Computer Graphics Society and the Founding Editor (1984) of its journal, *The Visual Computer*, as we will discuss later. He served on the Editorial Boards of the *Information Systems Journal* and the *Information Sciences Journal*.

He also assumed leadership positions in many international societies. In addition to the *IEEE Computer Society*, he was very active in the *International Federation for Information Processing (IFIP)*, specifically the Working Groups on Computer Graphics (WG5.10), on Data Bases (WG2.6), and Modeling and Simulation (WG7.1). He organized and chaired (1976–1981) the Special Interest Group (SIG) on Software Engineering for the Information Processing Society of Japan (IPSJ).

PROFESSIONAL ADVANCEMENT

Tosi received his B.Sc. (1962), M.Sc. (1964), and D.Sc. (1967), all in physical chemistry, from the University of Tokyo. In 1969, he joined the Faculty of Science, University of Tokyo. He was promoted to Professor, Department of Information Science, University of Tokyo, in 1978, and ultimately became the Chairman of the Department in 1986. He left the University of Tokyo in 1993 to become the Founding President and a Professor at the University of Aizu. In 1997, he joined Monolith Co., Ltd., as Senior Partner. His next position, between 1998 and 2003 was a Professor with Computational Science Research Center, Hosei University. From 2003 to 2008, he became a Professor and the Director of the IT Institute, Kanazawa Institute of Technology, Japan. He then joined industry as the Chief Technical Advisor at Morpho, Inc. Many of his later publications list his affiliation as Morpho, Inc., or Professor Emeritus, University of Tokyo.

Throughout his career, Tosi carefully selected his visiting appointments to add substance to his vision of a totally integrated computer environment for interactively processing complex visual information.

These yearlong appointments included Visiting Researcher, Stanford Research Institute (1973–1974); Visiting Associate Professor, Department of Computer Science, University of Texas, Austin (1978–1979); Visiting Professor, Computer Science Program, Electronic Engineering Department, Kogakuin University (1991–1992); Visiting Professor at the University of Geneva (1992); Visiting Professor at the University of California, Berkeley (1994); Honorary Visiting Professor, University of Bradford, U.K. (1998); and Distinguished Professor and Advisor, Beihang University, Beijing, China.

A UNITED VISION OF SOCIETY, CONFERENCE, AND JOURNALS

Tosi was deeply committed to and strongly supported the traditional societies such as IEEE Computer Society, various SIGs of ACM, various Working Groups of IFIP, and the Japan Societies Information Processing Society of Japan, among others. He held leadership positions in a number of conferences and journals sponsored by these societies. However, he was also very influential in founding societies and conferences that integrated technical communities dealing with focused subdisciplines of computer science, such as computer graphics, databases, multimedia, visualization, animation, etc. He assumed various leadership roles in more than 175 conferences.

In a few special cases where Tosi had some control by virtue of being a founder or a primary driver, he effectively promoted research in computer graphics by encouraging the unification of conferences, societies, and editorial boards into a meaningful whole. He was first successful in Japan and then in Europe as we shall see below. Rather than providing an exhaustive list, let's focus on an instance that exemplifies this far-reaching achievement. Tosi's motivation to establish a unified conference, society, and journal first deserves some attention.

In 1968, Tosi proposed to develop an interactive computer-integrated design system to incorporate fashion into the textile industry. The system would input and process complex visual information about fashion and output (display) textures of delicately curved cloth surfaces, usually with wrinkles. He referred to this system as a "visual computer" and presented preliminary results at the first SIGGRAPH conference in 1974.

Interestingly, the project uncovered a plethora of deeper research questions, such as the validity of intrinsic shape model properties beyond just displaying geometry; or the inconsistency of functional dependence in time-dependent visual database systems. Such broader questions make sense classified under a more encompassing umbrella such as information science; questions whose resolution required the cooperation of the broader community. Tosi raised such issues in the early 1970s as he encouraged the Science Faculty of the University of Tokyo to accept information science as a science discipline.

In Tosi's words, "Any science starts from a set of assumptions, then goes on to formulate or design models, and finally ends by realizing the results

through implementation. This way, it is clear that scientific research on a visual computer works to solve general problems beyond visual information."

Tosi also noted there was little motivation for the academic community to focus their research beyond the existing narrow specialized domains.

In 1983, he created a conference named Intergraphics, in Tokyo, to promote research in the deeper questions concerning the integration of the disparate domains. For the next three years (1984, 1985, 1986), the conferences were named, Computer Graphics Tokyo. In 1987, he gave the conference, held in Karuizawa, Japan the permanent name of Computer Graphics International (CGI). Thereafter, the conference venue rotated, and continues to rotate, annually to other countries around the world.

In the initial five-year period, Tosi guest-edited eight special issues of *IEEE CG&A* that included several selected, revised, and reviewed papers from these conferences.

In these early years of the conferences, Tosi also established the Computer Graphics Society (CGS) to ultimately assume the support of this conference series. (The conference sponsorship also included ACM SIGGRAPH, IEEE Computer Society, and Eurographics along with local sponsors.)

When it became clear that the community accepted the goals of these early conferences, he created in 1985, a new journal, *The Visual Computer*, published by Springer.

This journal completed the triad: a Computer Graphics Society to support both Computer Graphics International, an annual conference for presenting developing research, and to support *The Visual Computer*, a repository for archival research results. Quite a feat!

Originally, Tosi served as the President and Founder of CGS; as the Chair of the organizing and program committees of (CGI); and the Founder and Editor-in-Chief of *The Visual Computer*. As the conference matured and the venue moved to different countries around the world, Tosi reduced his involvement, becoming Program Committee Co-Chair and eventually Honorary Conference Chair; but always a member of the program committee.

Under Tosi's Presidency, the Computer Graphics Society accepted more responsibility for each succeeding conference until 1992 when it was formally founded in Geneva by Prof. Tosiyasu Kunii, Prof. Rae Earnshaw, Prof. Nadia Magnenat-Thalmann, and Prof. Daniel Thalmann.

Rae Earnshaw is well-known to readers of *IEEE CG&A*, because of his active participation as a member of the Editorial Board, as Guest Editor of special issues, and now as a member of the Advisory Board.

Nadia Magnenat-Thalmann also has a connection with *IEEE CG&A*, publishing 12 papers and Guest-Co-Editing the September 1998 issue on Virtual Humans.

Nadia Magnenat-Thalmann is the current President of the Computer Graphics Society.

The third element of Tosi's strategy to promote and disseminate advances in computer graphics is the Journal *The Visual Computer*, published by Springer-Verlag. Tosi established the journal in 1985 and remained its Editor-in-Chief through 1999, when Nadia succeeded him. Nadia is a very effective leader who has authored dozens of books and published more than 600 papers on virtual humans/virtual worlds and social robots.

The Computer Graphics Society is now in its 38th year of sponsoring the Computer Graphics International and *The Visual Computer* is the official journal of the society. The entire organization continues to gain prominence under Nadia's leadership. It has added another conference structure and a second journal.

This description clearly demonstrates Tosi's vision, dedication, and leadership: the establishment of a productive international, professional society dedicated to the promotion of advances in computer graphics by exchanging ideas and finding innovative solutions.

UNIVERSITY OF AIZU

Tosi held Visiting Professor appointments at Kogakuin University (1991–1992) and University of Geneva (1992) before assuming, in 1993, the position of Founding President and Professor of the University of Aizu. The university began as a project of the Prefecture of Fukushima to spur economic development. The Prefecture originally recruited Tosi to serve on the planning commission for the university, but later drafted him to be its first president. Tosi's motivation for making such a bold move was the following. He felt that computer science needed a focus in Japan in order for the discipline to thrive. At the time, he said computer science, in general, had not been recognized in Japan as a scientific academic discipline. As a result, Japan produced relatively few doctorates in pure computer science, while the need for pioneering research and discovery in computer science was growing worldwide. He was able to address this challenge successfully, based on his experience in helping create the Department of Information Science at the University of Tokyo.

His mission statement for the university of Aizu is "to advance knowledge for humanity," in other words, to make discoveries and inventions which will contribute to the peace and prosperity of people. Under Tosi's leadership, the University of Aizu is the first university in Japan dedicated exclusively to computer science and

engineering; hardware and software at both the undergraduate and graduate levels. He identified five fields of study: Computer Science, Computer Systems, Computer Network Systems, Applied Information Technology, and Software engineering with many subareas in each field. Tosi also established a network of UNIX-based workstations as the school's basic computer environment. Students have 24/7 open access to the networked workstations with better than a 1:1 ratio of computers to students. This was a natural step for Tosi, based on his vast previous experience with UNIX systems.

He had gained experience in the early 1980s porting UNIX to networked workstations. He was the first in Japan to contract the UNIX source code license for academic and commercial use from Bell Labs. In 1983, he exhibited the UNIX workstations at COMDEX in Las Vegas, again placing him among the pioneers of UNIX workstation network development worldwide. Soon after, he developed a broadband network with 500 sites for real-time control of various equipment and multimedia.

It is therefore not surprising that *IEEE Computer Society* awarded Tosi the 1998 Taylor L. Booth Education Award "for Initiating and Promoting Computer and Information Science Education in Japan and for Seminal Contributions Towards the Integration of Computer-Based Education in All Academic Disciplines."

In 2005, the University of Aizu was chosen by the Japanese government, along with 20 other universities, to be a national center responsible for the improvement of international education. In this role, the University carries out computer science research in collaboration with foreign universities. Other special recognitions by the government followed in 2014.

This is certainly a tribute to Tosi's vision and insight to create a strong foundation on which to build a unique public educational and research institution. The University of Aizu continues to grow and gain prominence.

CYBERWORLDS

In addition to the many conferences Tosi founded, organized, or supported, the International Conference on Cyberworlds has a particular significance. His original concept of cyberworlds or cyberscience dates back to 1969, at the time when the Faculty of Science at the University of Tokyo was trying to decide if information science is truly a legitimate discipline in science. As stated in an earlier section, in 1970, the Faculty formed the Information Science Lab to evaluate the "science legitimacy" of the research pursued there. Tosi, as an Assistant Professor submitted a proposal to the government to study cyberscience as an academic

discipline. He may have used this word at that time, but I am uncertain if he had been one of the first researchers to use this form of the term. I have not been able to document it. Regardless, he continued to pursue research on the foundations of cyberscience throughout his career. Terms such as homotopy type theory, invariants in modeling, and algebraic topological modeling are found in his later papers.

The word "cybernetics" was the title of the 1940s book by Norbert Wiener. The word "cyberspace" appeared in a 1982 short story (fiction). A company named Cyberscience Corp. was founded in 1977. Tosi's book, *Cyberworlds* was published in 1998. A book titled *Cyberscience: Research in the Age of the Internet* was published in 2003.

The concept of cyberworlds took a tangible step forward in 1993 when Tosi organized The International Workshop on Synthetic Worlds at the University of Aizu where he was President. The workshop explored the meaning, philosophy, and the potential of, worlds synthesized on the web, as well as in computational spaces in general. The proceedings were published in a book titled *Cyberworlds* (Springer-Verlag), co-edited by Tosi.

Advancing his vision to create broader community involvement in this topic, Tosi organized, in 2002, The International Symposium on Cyber Worlds: Theories and Practices, at Hosei University where he held a Professorship in the Computational Science Research Center. *IEEE Computer Society* published the proceedings, and selected papers were further reviewed and revised for publication in special issues of journals like *Computers and Graphics* (Elsevier).

In 2003, the conference finalized its name as International Conference on Cyberworlds (CW 2003) and is held annually in different countries around the world. In the period from 2003 to 2017, Tosi was recognized as the founder of the annual conference and often listed in the proceedings as Honorary Chair. In its formative years, he served as the Conference Co-Chair and as a member of the program committee of the conference. He often submitted papers to the conference, and at times was the Keynote speaker. More recently, Tosi handed over the leadership and organization of Cyberworlds to Professor Alexei Sourin, Nanyang Technological University, Singapore, for both the annual conference and publications.

In another connection to *IEEE CG&A*, the 2009 International Conference on Cyberworlds (CW 2009) was hosted by the University of Bradford, U.K. and Co-Chaired by Prof. Rae Earnshaw. As stated previously, Rae served on the *IEEE CG&A* Editorial Board and is currently a member of its Advisory Committee.

Establishing a seminal conference based on a new conceptual foundation, one that has now been accepted by the community and continues to thrive after 19 years is quite a legacy for Tosiyasu Kunii, and his successor, Alexei Sourin.

THE MAN BEHIND THE LEGACY

Tosi's legacy is truly multifaceted. Always a committed researcher at heart, his vision and intense dedication allowed him to open new technical vistas. However, he did not stop there. He also had the foresight, originality, and the leadership qualities to create and merge organizational entities so the total was greater than the sum of the parts. His underlying motivation was always humility as he strove to benefit society. Think of his motto for the University of Aizu, "to advance knowledge for humanity." During this massive undertaking as the President of the University, his scholarly contributions continued unabated. A second insightful motivation inspiring his work was the desire to build a more intense scholarly discipline of that portion of computer science that deals with information science; perhaps more popularly, but more narrowly, referred to today as cyberscience.

In the final analysis, we see a sensitive and empathetic individual behind this dynamo of activity; a colleague who encouraged collaboration with fellow researchers for the purpose of ultimately uniting of all those evolving technical results into a unifying theory.

This picture would not be complete without noting the importance of Tosi's wife, Dr. Hideko Kunii, in his life. Dr. Hideko Kunii has had an illustrious and satisfying career as a top-level executive in Japan's tech industry. She currently sits as an outside director on the Boards of three major Japanese companies. Her strong technical background led to the publication of papers and books, including a technical book coauthored with her husband. In her earlier years as a technical manager, she enjoyed a mutually beneficial, synergistic, university–industry exchange with her husband's graduate database students. We offer her and her family our deepest condolences for her loss.

Tosi's motivation, intense dedication, and enduring accomplishments certainly inspire us to strive for higher goals.