Remembering Vic Klee

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Mathematicians throughout the world were saddened to learn that Victor L. Klee, past President of the MAA, died on August 18, 2007 of complications following abdominal surgery.

Vic Klee was born in San Francisco in 1925. He earned his B.A. (with high honors) from Pomona College in 1945, majoring in both mathematics and chemistry. He wrote his thesis on Convex Sets in Linear Spaces under E. J. McShane, another past President of the MAA, and obtained his PhD in 1949 from the University of Virginia. More about his thesis will appear in the section on Klee's Mathematics.

After teaching for six years at the University of Virginia, Klee served on the faculty of the University of Washington from 1953 until his retirement in 1998. He had numerous visiting appointments and served as consultant for Boeing, Dupont, IBM, the National Security Agency, and the Rand Corporation, among others.

Klee and the MAA

Victor Klee was President of the MAA in 1971–1972. For many years, he was famous within the MAA for the "Klee Policy" forbidding deficits. When asked about this in 2006, he stated that "fiscal prudence has always seemed very important to me."

For his outstanding contributions to mathematics and mathematics education, the MAA gave Klee its Award for Distinguished Service to Mathematics in 1977. He also received three MAA awards for outstanding expository writing: the Lester R. Ford Award in 1972 for an article in the *American Mathematical Monthly*, and twice the Carl B. Allendoerfer Award, in 1980 and 1999, for articles in *Mathematics Magazine*.

When asked in 2006 what accomplishments as President he was most proud of, Klee responded as follows: "During the

Vietnam war, there seemed a very real danger that the MAA and AMS would be seriously weakened by resignations on the part of mathematicians who felt that the organizations were not dealing appropriately with their concerns. I particularly remember an MAA meeting at which, when entering the MAA business meeting, I was accosted by protestors with such rhetorical questions as 'Are you going in there with those pigs?' Before that business meeting, I had spent a lot of time studying parliamentary procedure, in the determination that everyone should not only have a fair hearing, but that they should realize that they had had a fair hearing. If my memory is correct, my best service to the MAA was in conducting that meeting, explaining the parliamentary rules and acting according to them. I was much pleased, after the meeting, when even some of the 'firebrands' complimented me on my handling of the meeting and said that, although not everything had been decided in the way that they had hoped, they did feel that they had been fairly treated rather than being denied their 'day in court'."

Klee helped to popularize mathematics. He wrote several general surveys, made a film, initiated and edited for several years an "Unsolved Problems" section in the *American Mathematical Monthly*,

and was featured in an expository film on unsolved problems of geometry that won honorable mention at the National Education Film Festival.

Klee and Students

Klee was an excellent teacher. One of Klee's strengths was the care he devoted to his students. His doctoral students had weekly conferences with him, at which he most actively helped them formulate their thoughts in an effective way, provided them with suggestions, and tried to cheer them up when the problems seemed to be overwhelming. He continued to give all of them help throughout their careers. A complete list of his PhD students may be found at the Mathematical Genealogy web site, at http://genealogy.math.ndsu.nodak.edu/html/id.phtml?id=15079.

Klee was also a mentor to many young mathematicians who went to Seattle to work with him during the critical (early) postdoctoral stage of their careers.

Klee's Mathematics

Klee was one of the most distinguished members of the University of Washington faculty. He was a very productive researcher, whose nearly 250 published works range over convexity, optimization, the theory of algorithms, and various aspects of combinatorics and geometry.

As a teacher and researcher, Vic had a gift for directing attention to interesting and productive problems. He looked at particular problems such as the facial structure of polyhedra, polytopes and convex bodies in simpler and more concrete ways with the goal of seeing what might hold in general. In a 2006 interview, he described the ideal problem thus: "The problem should be of intrinsic interest in even a very special form, but should admit of interesting extensions. In my opinion, a good problem is sufficiently specific so that even

the specific form is of interest to someone, but of course it's best if a specific solution inspires further questions and generalizations. I deal with a specific case, if a meaningful (i.e., not obvious but not impossible) one can be found. Then 'brainstorm,' looking for natural generalizations and, if possible, applications."

When Vic was asked in 2006 how he came to convexity as the topic of his thesis, he responded, "…I found, upon inspection, that the Calculus of Variations [the topic recommended by his advisor, E. J. McShane] was too 'messy' for my taste, though the geometric simplicity of the notion of convexity was very appealing. This led to the thought that 'If only I can prove enough theorems having to do with convexity per se, I won't have to work in the Calculus of Variations.'"

Vic's interests and achievements spanned many fields. He made important contributions to the study of finite and infinite dimensional linear spaces and convex sets in such spaces, to graph theory, to combinatorics, to determining the computational complexity of geometrical constructions, and other topics. He presented new ideas and methods along with stimulating open problems. His most valuable mathematical achievement, however, is in the theory of convex polytopes. His path-breaking and seminal papers, published in the 1960s, helped launch this field, a field that flourishes at present. Klee must be considered one of the founding fathers of the entire field. He retained an interest in convex polytopes to the end, and had, over the years, many students exploring this topic.

Member of the Mathematical Community

In addition to his accomplishments within the MAA, Klee's numerous honors include a Research Fellowship from the Sloan Foundation, three honorary degrees, the Guggenheim Fellowship, a Fulbright Research Scholarship, and election as fellow of both the American Academy of Arts and Sciences and the American Association for the Advance-

ment of Science. Over the years, Klee gave over 100 invited lectures throughout the world, including one at the International Congress of Mathematicians in 1974, in Vancouver.

Klee was a member of several American and international organizations and served on committees and as an officer of several of them. He was an Associate Secretary (1955–1958), and served on the Council and Executive Committee of the AMS. Klee served as chairman of Section A (Mathematics) of the American Association for the Advancement of Science, and he was on the Council of SIAM, the Society for Industrial and Applied Mathematics. He also served on the Council and Board of the Conference Board of the Mathematical Sciences.

Personal Observations of Friends

Robert Phelps: Victor Klee spent the 1955–56 academic year as a visitor at the UCLA mathematics department, where I was beginning my second year as a graduate student. Before he arrived, I overheard one of the faculty members refer to him as "the young hotshot from the University of Washington." I took his course on convexity and when I got stuck on a homework problem involving nearest points in convex sets, I started proving everything else about nearest points that came to mind.

Vic (still "Professor Klee" at that point) made some helpful suggestions and encouraged me to write up and submit my results to the *Proceedings of the AMS*. Having that paper appear during my third year of graduate school was a tremendous morale booster. By that time, of course, I had transferred to the University of Washington to continue working with Vic, finishing in 1958. While at UCLA, Vic, his then-wife Bitsy and another faculty couple had generously invited my wife Elaine and me to be their guests at a concert. Not having met him previously, Elaine had somewhat nervously visualized meeting a rather stuffy European with a graying beard. What she pleasantly found, of course, was another clean-shaven pun-loving Californian about our age.

Branko Grünbaum: The passing of Vic Klee should be an occasion to remember him, his character and his work, and the help of various kinds he has given to so many of us.

More than fifty years ago, while still a student in Jerusalem, I first came in contact with Vic. During the second round of letters he suggested shortening my addressing him from "Professor Klee" to "Klee", and in the next round, to replacing "Klee" by "Vic." This is just a small example of his friendly and open approach to people.

Vic was a very helpful colleague, always ready with references and other information about a variety of topics. He was also fair to a fault, happy to help out with classes if emergencies arose, and most thoughtful and meticulous in letters of recommendation he wrote. His lectures — whether in class, at the seminar, or in various meetings and colloquia — were always carefully thought out, and delivered in an inspiring and captivating manner.

One of Vic's lasting contributions to the UW department was the seminar he organized in the 1950s and led for many years. The seminar continues to this day. Over the decades, it went under various names — Convexity, Geometry, Geometry and Combinatorics, Combinatorics and Geometry, Combinatorics, reflecting the preferences and interests of its organizers — but the spirit did not change much. The regular participants formed a community with frequent contacts and exchanges. Often the attendance shot up during the Summer Quarter, as this was one of very few offerings that presented new ideas and recent results.

Peter Renz: I came to Washington in 1961, interested in analysis and topology and knowing no convexity. Klee captured me. Like a geologist, he surveyed new territory rich with interest. He showed how intersection properties of convex sets led to surprising results. How shifting from Euclidean spaces to Banach spaces or to linear topological spaces over fields could give new results and revealing examples.

For Klee, mathematics was inexhaustible, endless exploration. He welcomed progress by others along with his own. He was open to ideas of colleagues or students, equally. He was cautious and critical. As a student, when I brought him an idea or proof, he would lean back and say "Let me see, do I believe that?" Then I would sweat about whether I had checked carefully. If not, he would nail me. Vic taught us boldness and caution.

Klee's curiosity and broad interests led him to pose many appealing problems. He wove these through his classes. Students, including David Barnette and Kit Hanes and Joel Berman, earned early publications by solving such problems. Some were easy, others beyond reach, but all were intriguing.

In 1976, I was working for W. H. Freeman and Company and was delighted when Vic became our series editor. The fruits of his efforts included: Computers and Intractability by Micheal Garey and David Johnson (1979), Linear Programming By Vasek Chvatal (1983), *Tilings and Patterns* by Branko Grünbaum and G. C. Shephard (1987), and Problem Solving through Recreational Mathematics by Bonnie Averbach and Orin Chein, Dover reprint with additions in 1999. All are still in print and highly praised.

Klee was adventurous. In Hong Kong he and his wife, Jodey, tried a durian — the fruit so smelly that hotels won't let you take it to your room. He liked it. On returning to Seattle, he found some durian ice cream, which he offered me. I declined. When I do sample a durian, I will think of him.

Klee's openness to people and ideas, his wit and good humor, and his drive to excellence made him a wonderful human being.

Kenneth Ross: I took graduate topology from Klee in winter and spring 1957; this was my first year of graduate school. He thought highly of me (Bob Phelps told me so). In fact, since Klee was going to be away for 1957–1958, in the spring of 1957 he went to Edwin Hewitt (who barely knew me) and asked

him if he had room on his grant for me. Hewitt asked whether I'd be a satisfactory note-taker for his real variables course. Klee evidently assured him, because I was on Hewitt's grant and was his note-taker. I ended up writing my thesis under Hewitt's guidance, and the rest is history.

Later, in 1969, I was asked by AMS Secretary Everett Pitcher whether I'd be interested in being Associate Secretary for what we now call the Far Western Section. I wasn't sure whether this was a good idea career-wise, so I called my mentor in Seattle — no, not Ed Hewitt, but Victor Klee. Klee started out by saying that he was the one who recommended me to Pitcher, so that turned out to be a short conversation, and I took the job. That job eventually led Len Gillman, then Treasurer of the MAA, to ask me about being MAA Secretary (without any previous MAA experience!), and again the rest is history.

One Friday in that topology course, Klee ended by stating an unsolved problem (from John Isbell). Something about fixed points of commuting maps. Then Klee told us that he would talk about XXX on Monday, unless of course one of us had solved the problem. Well, John Rowland and I independently solved the problem that weekend. We got together and merged our solutions into a short elegant solution. On Monday morning, Klee asked whether any of us had solved the problem. I said that John and I had. Klee was incredulous and dubious, but invited us (me) to give the solution. Each sentence was so clear, that Klee impatiently pushed me on. After about three sentences, I was done. Klee was stunned, clearly convinced, but puzzled. When he went back to Isbell, he discovered that he (Klee) had misstated the problem slightly. What we had solved was pretty simple. Still, I think Klee was impressed that John and I would tackle an alleged unsolved problem.

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Peter Renz taught at Reed, Wellesley and Bard, and was an editor at W. H. Freeman and Company, Birkhäuser Boston, and Academic Press. He also served as associate director of the MAA in Washington.

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