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Algebra Universalis

Reminiscences about George Grätzer and E. Tamás Schmidt

The following pages contain remarks on the life and work of George Grätzer and E. Tamás Schmidt by László Fuchs, Barbara Beeton, and Gábor Czédli.

Grätzer and Schmidt

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In the 1950s, the curriculum at the university in Budapest was very rigid: everybody in the same program had to take the same courses and pass the required examinations at the end of each semester. In addition to the mandatory courses, several professors offered 'special courses' for which no credit could be earned; they were open to advanced students who wanted to learn more about their subjects than just the curricular topics. In the fall semester of 1954, I offered a special course in algebra, this time on lattice theory and ordered algebraic structures. I had my first class in the afternoon, on a sunny day in late September. Many students showed up. I used to know well all the students in my special courses. They had taken my basic algebra class in previous years, and in addition, they had oral examinations with me for two semesters, so I had 30–40 minutes of one-on-one contact with each of them. This time it was different. There were two unfamiliar faces: two first year students who secured special permission to attend this course that was open only to students from the second year on. I was pretty sure that sooner or later they would quit coming. I was wrong; the entire semester they were sitting in the middle of the first row, listening very carefully and occasionally whispering to each other, apparently to clarify some points in my presentation—from this I gathered that they did follow the course. Those two freshmen were George Grätzer and Tamás Schmidt.

They were also students in my first year algebra class, and at the end of the semester, it was their turn to take the examination. The exams were oral: each student was given two topics to elaborate with precise definitions and detailed proofs, in addition to solving a problem. Of course, both George and Tomi earned the highest grade. But there was a special twist. The students had to bring a booklet (called an 'index') in which the examiner entered the grade, and George, by mistake, switched his birth date with the enrollment date in his index. Thus, officially he was four months old, and so I congratulated him by pointing out that I have never had before such a young student earning such a high grade. I thought that being so absent-minded at such an early age (even as an 18 year old) might point to a successful career as a mathematician—and I was right!

I learned that George and Tomi had been good friends before they entered the university. As most Hungarian mathematicians, they grew up with problem solving for the high-school mathematical journal and participating in national competitions. But this did not satisfy their thirst for knowledge; they were more ambitious and wanted to learn more of higher mathematics. To this end they formed a mathematics club for high-school students that soon developed into the youth division of the Bolyai Mathematical Society. They invited established mathematicians to speak about interesting subjects. One of the speakers was L. Fejes-Tóth, the well-known geometer. He gave a series of talks on his newly published geometry book. George and Tomi (then in the 12th grade) found an elementary proof of a result presented by the speaker. Fejes-Tóth liked their idea so much that he planned to include it in a revised edition of his monograph.

Grätzer and Schmidt seemed to have gotten hooked on lattice theory. Already in their second academic year they studied the subject very thoroughly by reading G. Birkhoff's *Lattice Theory* and working on problems quietly by themselves. They never came to me to ask questions; either they did not trust that I would have the answer or they wanted to force themselves to come up with the answers.

No picture of them would be complete without mentioning that they were always seen together, like twin brothers. They worked as a team, joining forces to attack several open problems listed by Birkhoff. It was an amazing cooperation between two congenial individuals committed to a common cause. They were third year students when they came to my office with a finished manuscript containing a solution of a problem in Birkhoff's book that asked for a characterization of lattices having a bijection between ideals and congruence relations. I was not up-to-date in lattice theory literature, so I asked them if they had checked in the Mathematical Reviews whether or not the problem was still open. This was the first time they heard about the Mathematical Reviews! Shortly afterwards they told me the bad news that the problem had been solved by Hashimoto. Of course, they were very disappointed. To comfort them, I pointed out that this happens to all research mathematicians, and they should be proud that they completed successfully important research, just like established mathematicians.

Already in the third year of their studies they were active participants in our research seminar in algebra that our university ran jointly with the Mathematical Research Institute of the Academy. This was a lively forum in a cordial atmosphere, where both finished works and research in progress were presented and thoroughly scrutinized. The main speakers (E. Fried, G. Grätzer, E. T. Schmidt, O. Steinfeld, F. A. Szász, and R. Wiegandt) were interested in diverse branches of algebra, so the topics covered a wide spectrum. George and Tomi often presented their new results, which were then opened to criticism and discussion in the seminar. They could not be stopped. They completed and submitted more than a dozen papers before

graduating from the university. (They published mostly in Hungarian journals, because at that time permission was needed for publishing a paper abroad—quite a nuisance.)

They also took other subjects in mathematics, especially in algebra, very seriously. When A. G. Kurosh, the prominent Russian algebraist, visited us and impressed us with the increasing importance of non-associative rings, we organized a year-long study of the subject in the algebra seminar. Not only were Grätzer and Schmidt very active in the presentations, but they also found a new associativity result for alternative rings. A similar situation occurred when we studied abelian groups: they came up with two papers on the subject. They were also successful in mathematical competitions for university students.

Shortly after their graduation, they entered the international scene. In 1959, Reinhold Baer organized a conference on Ordered Sets in Oberwolfach. George and Tomi were invited speakers. Their contact with foreign mathematicians expanded as rapidly as the number of their publications increased. In 1960, they received the degree equivalent to Ph.D. (called Candidate of Mathematical Sciences). In the same year, they were awarded the Grünwald Memorial Prize of the Bolyai Mathematical Society. Their collaboration continued in full swing, and during this period their joint research culminated in the well-known and highly regarded Grätzer–Schmidt Theorem on the characterization of congruence lattices of algebras, published in 1963.

I do not feel competent to comment on their research accomplishments, so I will stop here. Browsing their impressive publication lists that stretch over half a century, I could not help but wonder what would have happened to them if I had not offered the special course in lattice theory in 1954. (As a matter of fact, for that semester I was not planning a special course, because I had just become the dean and was overwhelmed by the mounting problems of seventeen departments. But I just could not leave my interested students without a special topic in algebra, so at the very last minute I decided to offer this special course.) I have no doubt that even without lattice theory George and Tomi would still have had a most successful career in mathematics. But all of us who now celebrate the 70th birthdays of two distinguished friends and colleagues are happy that our celebrants chose lattice theory and universal algebra as their main research areas. Their contributions have had a considerable impact on developing the theory to its present high level. And this is not the end. It is a great pleasure to see that they are still working with youthful spirit and never decreasing enthusiasm, and they continue to enrich their areas with new ideas and many interesting results.

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George Grätzer and LaTeX

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George Grätzer has been a practicing mathematician all his professional life, but the rôle in which I've known him for more than ten years is complementary: as a strong proponent of LaTeX, and, more specifically, of AMS-LaTeX.

George started writing articles about LaTeX for the *Notices of the AMS* in the early 1990s, nearly as soon as LaTeX had been turned over to the group now known as the "LaTeX 3 Project" and they had collaborated with Michael Downes of the AMS staff to incorporate the math features of AMS-TeX. George's rationale for why one should use AMS-LaTeX is a model of clarity, convincing to the most technologically challenged among us. (He predicted that AMS-LaTeX would be a fully official component of LaTeX "[o]nce the LaTeX 3 project is complete". Official acceptance came long ago, but we're still using LaTeX 2_ε.)

But selling the concept of the system was not enough; George felt compelled to help people use it properly, and his career as an author of works *about* LaTeX, not just using it, began. This, in turn, inspired him to make suggestions about improvements to AMS-LaTeX, many of which have been adopted.

George's current offering on the shelves is the book *More Math Into LaTeX*, a tutorial for AMS-LaTeX that is as good as one will find anywhere—and considerably more thorough than the skimpy manuals available from AMS. (This is the 4th edition. The previous edition was one of Amazon's "editor's choice" picks of the year for 2000.) This is the manual that AMS recommends to its authors. After all, with George doing the heavy lifting, there's no reason for us to write our own.

Happy birthday, GG, from bb.

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G. Grätzer and E. T. Schmidt, mathematicians

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1. Personal impressions

Professors George Grätzer and E. Tamás Schmidt are, and have been for decades, amongst the leading experts of lattice theory and, also, of universal algebra. Their longstanding and fruitful collaboration—resulting in 61 important joint papers—is quite unique.

I came across their name via the classical Grätzer–Schmidt theorem in the mid seventies, when I was a graduate student. While most of the classical results were presented in the classroom with detailed proofs, we—the students—were told that the Grätzer–Schmidt theorem is too deep to be given with full proof. This fact gave some legendary fame to Grätzer and Schmidt in our eyes.

A few years afterwards, Professors George Grätzer, although he was not aware of this, and E. Tamás Schmidt became my teachers. Indeed, right after getting my master's, I started to study Grätzer's books[1] [GB 1] and [GB 3] . Then, in 1983, Professor Schmidt became my Ph.D. thesis advisor.

It is hard to overestimate how useful the books [GB 1] and, mainly, [GB 3] were in developing my career. While Birkhoff's "Lattice Theory" made it clear that lattices are quite useful in many branches of mathematics, it was "General Lattice Theory" [GB 3] that taught me that the world of lattices is an exciting, beautiful one. This book cites Lewis Carroll's Alice: "and what is the use of a book without pictures and conversations", and does what Alice would like. The very clear style, the nice presentation with about 130 figures, and the carefully selected rich overview of lattice theory made a great impact on me. Naturally, this book became my reference book. I am sure that many colleagues, the majority of those of my age, share my opinion.

Clear presentation is evident in all of George Grätzer's books, including the latest one, the "proof-by-picture" book [GB 7]. Nowadays that Professors George Grätzer and E. Tamás Schmidt are my friends, the pictorial approach has a quite personal aspect: it was George who taught me how to make diagrams for my papers. In fact, he taught me many other things, ranging from chess to lattices, and his wide knowledge of practically everything and his effectiveness always impressed me.

[1]The reference numbers prefixed by one or two letters refer to the list of publications in the following article; B stands for books, P for conference proceedings, GS refers to the *Grätzer and Schmidt* list, G to the *Grätzer minus Schmidt* list, and S to the *Schmidt minus Grätzer* list. A prefix within the same pair of brackets is not repeated.

My good relation with Tamás continued after I obtained my Ph.D under his guidance. We have been supported by the same Hungarian research grants for two decades, met many times, and became coauthors. Tamás impressed me with his kind personality and the richness of his mathematical ideas.

2. More about Grätzer

George Grätzer was born in Budapest, Hungary in 1936. After graduating in 1959, he started to work at the Mathematical Institute of the Hungarian Academy of Sciences (now named after Rényi), in Budapest. He obtained his Ph.D. from the Hungarian Academy of Sciences in 1960, and lived in Budapest (Hungary) until 1963. Then he became a professor at the Pennsylvania State University. Since 1966 he has been a professor, now distinguished professor, at the University of Manitoba. He is a Canadian citizen and is married with two sons and four grandchildren. His mathematical family is even larger; in particular, he was the thesis advisor of fourteen successful Ph.D. students: Chuan Chong Chen, Brian Davey, Kee Mengh Koh, Harry Lakser, William A. Lampe, Shi-Min Lee, Peter Penner, Craig R. Platt, Bill Sands, Tey Tan, Ivan Rival, Robert Vancko, Dabin Wang, and Günther Wenzel.

As a mathematician, Professor Grätzer has received many honors and awards; I mention only a few. He is a Fellow of the Royal Society of Canada (since 1973), a Foreign Member of the Hungarian Academy of Sciences (since 1997), and was awarded the Doctor of Science (Honoris Causa) by La Trobe University (Melbourne) in 2005. He won the Steacie Prize of the National Research Council of Canada in 1971 and the Szőkefalvi-Nagy Medal of Acta Scientiarum Mathematicarum (Szeged) in 2003.

Besides mathematics, he received several first prizes in international competitions in chess compositions when he was young, and his first book [GB 17] is a book on (mathematical) puzzles. We readers of AU know and respect Professor Grätzer not only for his mathematical results and fundamental reference books; for us, he is the founder of Algebra Universalis, our favorite journal. He has been the Editor-in-Chief of AU since its inception in 1970. He has done a lot for our large family.

I am glad to note that nowadays Professor Grätzer is as productive as he has always been. Indeed, in addition to [G153–156], which are accepted for publication, he has four new submitted papers (not listed here). The number and depth of his mathematical papers and books are very impressive and made a very significant impact. For example, E. Garfield[2] listed him among the 200 most cited mathematicians in 1978 and 1979 (despite the fact that papers published in Algebra Universalis

[2]Essays of an Information Scientist **5** (1981–82), 666–675.

were not included). Since many mathematical journals are not monitored by the ISI (Citation Index), it is impossible to know how many times he has been cited. However, to obtain a good estimation, anybody can compare his known total number of citations with the number coming from ISI. I came to the conclusion that Professor Grätzer has been cited at least six thousand (approximately 6,500) times.

To most mathematicians, George Grätzer is known for his books on LaTeX that have sold almost 40,000 copies. The third edition of his best known LaTeX book [GB 12] was chosen by the math editor of Amazon.com as one of the top 10 books of the year 2000, out of more than 3,000 books.

3. More about Schmidt

E. Tamás Schmidt was also born in Budapest in 1936. After graduating in 1959, he started to work at the (Rényi) Mathematical Institute in Budapest. He obtained his Ph.D. from the Hungarian Academy of Sciences in 1960. So, at the beginning, his life is very similar to that of his friend, George Grätzer.

E. T. Schmidt achieved a higher Hungarian scientific degree, Doctor of Mathematical Science, in 1969. He remained at the Rényi Mathematical Institute until 1991, the last twenty years as the deputy director of the Institute. This position required a lot of administrative work, but his next job required even more. In 1991, he became a professor at the Technical University of Budapest and the head of the Department of Algebra for the period 1991–2001. He reorganized the mathematical departments of several faculties into one Mathematical Institute, and he became the first director of this institute in 1995, a position he retained until 1999. He retired in 2006 and is now a professor emeritus. As a result, his mathematical activity has increased, as witnessed by four recently submitted papers.

Professor Schmidt has had an important role in Hungarian Algebra. He was the thesis advisor of seven Ph.D. students (Hoang Minh Chuong, András P. Huhn, Lajos Klukovits, Kurt Neumann, Sándor Radeleczki, Manfred Stern, and myself). He served on the editorial boards of Studia Sci. Math. Hungarica (1971–1992), Beiträge zur Algebra und Geometrie (1970–) and Algebra Universalis (1991–2007). He was a visiting professor at the University of Calgary (1987–88) and visited the University of Manitoba three times. Thanks to his fluent German, he was a visiting professor at the Martin Luther Universität, Halle (1965–68) and Gesammthochschule Kassel (1980-81).

Professor Schmidt received several honors and awards in Hungary, including the Mathematical Prize (1974) and the Farkas Bolyai Prize (2004) of the Hungarian Academy of Sciences, the Széchenyi Professorial Scholarship (1999–2002), and the Szent-Györgyi Prize awarded by the Ministry of Education (2006).

He is married with two sons and three grandchildren, and he likes to spend a lot of time with them.

4. Finally

I wish happy birthdays to Professors Grätzer and Schmidt! Further, I wish to all of us that they continue proving a lot of new theorems for many years to come.

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