With Coxeter at the International Congress on Mathematics Education-7

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The Coxeter tribute here at the International Congress on Mathematics Education-7 (ICME) in Quebéc City, took place Wednesday, 19 August, beginning at a small dinner and then continuing at a well-attended film presentation at Laval University At the end, there was a short talk by Coxeter that he almost didn't get a chance to give. Here's how it happened.

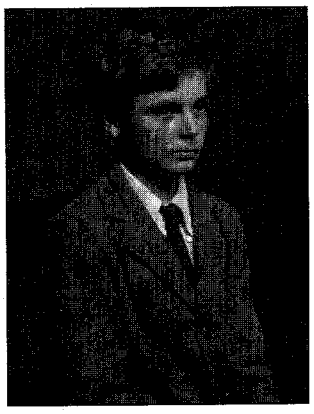
On Tuesday morning, I had run into the Coxeters and Michele Emmer near the ICME registration desk, where they were talking to the member of the program committee who had set up the film program. Mrs. Coxeter was explaining that someone had told her husband earlier this Spring that he would be asked to make a presentation, and he had gone to the trouble of preparing one, only to find that there was no slot scheduled for him on the final program. Since there were different persons responsible for different parts of the program, it was easy to see how confusion could arise. One suggestion was that Coxeter could talk at one of the afternoon working groups on Art and Mathematics, but that posed problems since the schedule for those sessions seemed tight and, as Michele pointed out, the audience included only a small fraction of the people who would like to be present to hear and honor Coxeter. The best time seemed to be Wednesday evening after the films featuring him that were to be shown in his honor, especially when he said he could cut his remarks down to half an hour. Unfortunately, it wasn't obvious who should act on this suggestion, and no one did, an omission that nearly caused an awkward situation the next night.

Tuesday evening, Michele Emmer and I were scheduled to present our films and videotapes, and both of us had independently decided to dedicate our presentations to Coxeter. Although the International Congress on Mathematics Education had about 3500 participants, we did not expect too much of a turnout for a film presentation at 8 pm in a town with hundreds of very good restaurants. We were pleased when nearly two hundred people assembled, especially since Professor Donald Coxeter and his wife Rien were in the audience.

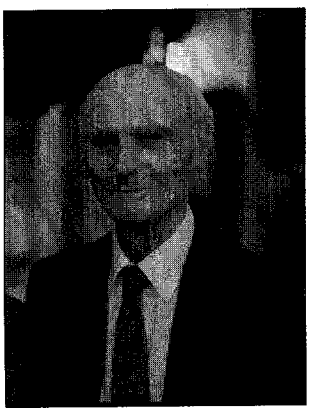
At eight o'clock Tuesday night, I began my presentation in the University theater by dedicating it to a young student, whose picture I showed on the screen. I explained that I had become fascinated by higher dimensions when I was a high school student and that this fellow had written his first paper on Dimensional Analogies, when he was sixteen. Twenty-four years later he expanded his ideas into the classic book *Regular Polytopes*, which was first published in 1947, forty-five years ago. At that point, I introduced Professor Coxeter, who stood up to acknowledge the full applause of the audience.

During my presentation I referred to the contributions of Coxeter several other times. I showed videotape footage of the interactive electronic book version of my Scientific American Library volume *Beyond the Third Dimension* (which Coxeter had reviewed in the *American Mathematical Monthly*), and said how nice it would be to have an interactive book version of *Regular Polytopes* so readers would be able to make the three- and four-dimensional diagrams rotate and change on a computer graphics screen. When I introduced the videotape *The Hypersphere: Foliation and Projections*, I referred once again to ideas from Coxeter's *Regular Complex Polytopes* and showed my slide of a decomposition of the regular 24-cell in four-space that I had developed in a correspondence with him.

I finished my presentation at nine and said that the next films and videotapes would be introduced presently by Michele Emmer. But



H.S.M. Coxeter at age 16,



and at age >16.

Michele came to the microphone looking very dejected. Despite the assurances he had received, the tapes he had brought from Italy would not work on the system in the projection booth. Although the technicians had worked very hard to solve the problem all during my presentation, it was impossible for him to show any of his tapes, including the one about Escher featuring Coxeter. He did have with him one film, the final version of *Flatlandia*, so he was able to show that, and he was able to remind people that another of his films would be shown the following evening.

The ICME working group on Art and Mathematics met both Tuesday and Wednesday afternoons, and this was the group Coxeter himself had chosen to attend. It was a photo opportunity for several of the participants, some of whom were meeting their geometrical hero for the first time. After a presentation by Ronald Brown from Bangor, Wales on the sculpture of John Robinson, Coxeter shared with the hundred or so people there a model of four interlocked rings that had been sent to him by an amateur mathematician, and which related to a structure created by Robinson. The final presentation on Wednesday afternoon was on the Alhambra, but Coxeter had to leave early to get ready for the evening event. Someone suggested that he probably had seen enough of the Alhambra in his long career, and it was surprising to learn that he had never been there. One of the people standing by said that they would have to remedy that when the next ICME is held in Seville in 1996.

Wednesday evening at 5:30 those of us invited to a small dinner in Coxeter's honor assembled at the registration desk, among them William Moser. It was only in the car going to the restaurant that I realized that he was the Moser who was the co-author with Coxeter of the 1957 classic *Generators and Relations for Discrete Groups*. On the ride over, I sat next to Asie Weiss from York University and when asked, she said yes, she was a student of Coxeter, in fact his last PhD student and the only female among seventeen PhD students. There was speculation in the car about why Coxeter had had seventeen doctoral students, and someone suggested that probably each of them was associated with one of the repeating two-dimensional patterns decorating the walls of the Alhambra.

By the time we got to the University theater for the films, the audience was pretty well assembled in the theater, with at least twice as many people as the previous night. The first film shown was *I Solidi Platonici*, by Michele Emmer, with Coxeter as the narrator in several parts. The

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November 27: Problems at the University of Bridgeport and at Columbia worry me a bit. At Bridgeport, they are having a financial crisis, and may have to dip into endowment funds in order to pay faculty on the 29th. At Columbia, the heads of a number of departments are threatening to resign if the administration there follows through on attempts to cut some programs. Are the places I have applied to, particularly those who caution that the available position "depends on funding approval," in at all in similar shape?

On the other hand, my office-mate from last year, Brenda Latka, tells me that Lafayette College, where she has a position, will be hiring again this year and that they are working on the announcement. How many places out there have made similar decisions this week?

November 30: Today I decided to not apply for four positions that I had earlier decided to apply for. I also worked through a new list of positions I got from e-MATH, rejecting many that I felt I was not qualified for or overqualified for. For instance, a few places said they would "prefer an algebraist" or said that "master's degree required." I didn't like this line in an announcement by the University of Missouri: "Selections for the position will be based primarily on demonstrated research achievement in an area complementary to areas of ongoing departmental research," in part because earlier in the announcement they paid lip service to quality teaching and because I feel that one of the strengths of my applications is my teaching experience.

I've spent a lot of time with this process already, and I am getting tired of it. I'm not so quick to say, "It won't hurt to apply there, too."

However, since some of these positions have application deadlines in February or March, I may still have a long way to go. I'm also expecting the new AMS *Notices* this week.

December 5: Here's the score at this point: I have 40 applications out. A Chinese student in our department has 60. Two Americans that I know are just starting to apply, and a third American has 4 applications out, since he wants to stay in New Jersey.

I have more thoughts about better ways to word these job postings. Why can't departments be clearer about who they want to apply for these positions? I appreciate the departments that say" please send a copy of your most recently published paper," since it says to me: "if you haven't had anything published, don't apply." I would like to see ads that say "this position is intended for new PhDs." I understand that departments like to be vague in their position announcements so as not to turn away someone who actually might be a good fit, but, on the other hand, if your search committee is tired of swimming through applications, maybe the announcements should be more direct so as to get fewer applicants. Some ideas: "only graduates of Princeton, Harvard, or Berkeley need apply"; "if you do not enjoy teaching, don't even think of applying here"; "this is a tenure-track position — we are NOT hiring new PhDs." OK, maybe I'm getting a bit silly here.

To be continued . . .

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second, *Dihedral Kaleidoscopes*, featured a somewhat younger Coxeter demonstrating how to generate plane-covering regular and semi-regular tesselations by using vertical rectangular mirrors set at various angles and polygons made of colored paper. Both films were roundly applauded.

Between the films, Moser went to the podium and said some extremely nice words about Coxeter as teacher, co-author, and friend. One thing that delighted the audience is that the Coxeters would be celebrating their fifty-sixth wedding anniversary the following day. In preparation for this evening, Moser said he had gone through his Coxeter files and had come up with several sentences and paragraphs worthy of quotation. For example, in a 1979 interview, Coxeter characterized himself by saying. "I'm someone who tries to find out mathematical truths—and I enjoy doing it."

At the conclusion of the second film, I expected Coxeter to get up and speak, but it was announced that, although Professor Coxeter had planned to say something, the schedule indicated that the next set of films would begin in fifteen minutes, so there wasn't time. Fortunately someone went up to the organizers of the film program and asked if it would be possible to hear Coxeter, at least for the duration of the break before the next films, and when that was suggested to the audience, everyone enthusiastically signaled approval. A moment later, there was Coxeter up at the podium showing some of his favorite Escher images and telling stories about how diagrams from hyperbolic geometry inspired the artist to create some of his most memorable designs. One, based on crosses on a Poincaré disc, Escher said he should probably send to the Pope. Another was a four-color fish design the original of which hangs in the Coxeter home in Toronto. At the end, he showed some transparencies by a new artist, Russell Towle, whose work incorporates many images from geometry. And then he was done, in just fifteen minutes. The rest of the film program was hardly delayed at all.

The people who had been at the dinner left at this point and stood around in the foyer talking appreciatively about the events of the evening. Coxeter and his wife seemed very pleased indeed. He gave to Michele and me copies of his most recent research article, on the evolution of Coxeter-Dynkin diagrams, written last year, sixty years after he had first introduced them, nine years after he had written his paper on Dimensional Analogies as a sixteen-year old. Someone recalled the last quotation Moser had presented, taken from a convocation speech by Coxeter in 1979: "The best that I can wish for each of you is that you may have as full and happy a life as I have had and am still having." To which we all said, "Amen!"

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mental faculties, but motivation and support. Let's spread the word, motivate students, and support their progress!

It is important to point out that the IMO is a celebration of mathematical talent more than a competition for mathematical supremacy. The team scores are unofficial and informal, and the international rivalries are friendly and good-natured. This summer, the Americans made friends with participants from Romania, Russia, Cyprus, Argentina, Colombia, South Africa, Australia, Germany, Taiwan, Trinidad, and other places. The focus is on cultural exchange, friendships, and mathematics; the competition is there to invigorate that exchange, those friendships, and mathematics. We play this game hard and we play to win, but the real impact of the IMO has little to do with winning and losing and team scores. What is most important is fostering mathematical talent, encouraging mathematical achievement, and unifying the mathematical world. The IMO is an important tool in this effort.