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Abstract: *Herbert Tate was a Professor of Mathematics at McGill University (Montréal, Canada) from 1921 to 1964. As the author of four textbooks, and in his capacity as Chairman of the Department of Mathematics from 1948 to 1960, he played a key role in structuring the institution's research and study programs in mathematics during an important period of growth. McGill's current position as a hub of mathematical research owes much to him. In this interview given shortly after his retirement, Herbert Tate describes his career and shares some of his views about mathematics and related topics. Beyond its archival value, this interview reminds us of the extent to which infrastructures and mentalities have changed, at least in Canada, over the past century.*

Keywords: Mathematical education · Mathematical history · McGill University

Mathematics Subject Classification: Primary 01A72; Secondary 01A70

1. Introduction

Herbert Tate studied mathematics at Trinity College, Dublin. After completing a Master of Arts, he moved to Montréal, Canada, in 1921 to teach mathematics in the newly created School of Commerce at McGill University. A pioneer of actuarial education on campus, he wrote four textbooks summarizing some of his teachings: *Interest, Annuities and Bonds* (Tate, 1929), *Elements of the Mathematical Theory of Interest* (Tate, 1937), *Elementary Mathematical Analysis* (Tate, 1946), and *Mathematical Theory of Interest* (Tate, 1947).

Herbert Tate was a scholar but not a researcher by today's standards. His only entries on *MathSciNet* are solutions to problems in *The American Mathematical Monthly* published between 1936 and 1938; see Gelbart & Tate (1936), Claudian & Tate (1937), Levenson, Locke & Tate (1938), Musselman, Tate & Sparrow (1938), and Underwood & Tate (1938). Nonetheless, Herbert Tate was highly influential, both as an educator and as a builder of mathematics at McGill. He chaired the Mathematics Department from 1948 to 1960, in a period of rapid growth. Through his work and vision, the department got a head start in research on the Canadian scene and developed an enviable worldwide

reputation that it holds to this day. Professor Tate retired in 1964 and was made Emeritus the following year. McGill still runs a loan fund in his name that gives special consideration to "those who, like the donor, begin a university education as mature students and require financial assistance."

Below are excerpts from an unpublished interview of Herbert Tate that Lorne Gales and Albert Tunis conducted at McGill on June 2, 1964. It is one of a handful of interviews with academic staff available only in reel-to-reel audiotape format from the McGill University Archives Audio Collection. The original quotes are verbatim but the material was reorganized somewhat to improve the flow. I also added occasional words and a few details in square brackets for clarification. Information about people mentioned in the interview is also provided wherever possible either via footnotes or Web links accessible by clicking on names in blue.

Beyond its archival value, this interview reminds us of the extent to which both the infrastructures and the mentalities have changed, at least in Canada, over the past century. This paper is intended as a tribute to a man of his time, modest and efficient, who truly believed in mathematics education and devoted his entire life to it, with much success and — to this day — little recognition.

2. Recruitment

Q: Professor Tate, I'd just like to take you back a bit in years. I find that rather interesting in talking to members of Faculty who've been here for some time to find out how they first came to come here. You know what I mean.

T: Well, that's very interesting. I was brought to McGill primarily through the efforts of Professor R.M. Sugars [Associate Professor of Spanish], who was Director of the School of Commerce. He wanted somebody to take over mathematics in the School of Commerce and at that time — it was after the First World War — there was a world shortage of mathematicians. And he went to the Chairman of the [Mathematics] Department, who in those days was Professor James Harkness, and asked him if the department could get somebody to take charge of mathematics in the School of Commerce. I understand that Professor Harkness said it was impossible; he couldn't even get some people for his own division. Well then, Professor Sugars said: "If that is the case, if you leave it in my hands, I will guarantee to get somebody." So he wrote to his old university, Trinity College in Dublin, and to the Vice-Provost [Thomas Thompson Gray], who, by the way, was a very famous classical

scholar, who sent it on to the Professor of Mathematics who had been my tutor, and he said: "If you wish to apply for this post, I will not approach anybody else." And that is the way I came to McGill.

I was appointed Assistant Professor in 1921. Now, in those days, the future of the School of Commerce was uncertain, as it is today [1964]. It always has been uncertain. Nobody has ever known whether it should be in the university or not, or whether, as it is here, whether we should keep on with it. And the letter I got from the Principal, Sir Arthur Currie, mentioned that my immediate and probably permanent work would be with the School of Commerce. And when I came out, I asked him what was the meaning of that. "Well," he said, "we're not quite sure whether the School of Commerce would be here in another two or three years. But," he said, "you'll be all right! You'll be all right for that reason," he said, "still we have made you a member of the Mathematical Department, rather than a member of, solely, the School of Commerce."

3. Development of Mathematics at McGill

Q: Professor Tate, from your vantage point now, after 43 years, I wonder if you could look back and indicate to us, broadly, how mathematics at McGill has developed from when you first came.

T: Oh yes. When I first came to McGill in 1921, the Mathematical Department was quite small. It was, for all practical purposes, in two divisions. Arts and Science with a Full Professor at a head, Professor Harkness, who was a very distinguished Cambridge mathematician, and Engineering, with a Professor of Applied Mathematics, Professor Daniel Murray, at a head of that. Now, the Department as a whole only met together when matters of common interest were at stake. But for all practical purposes, it was two separate departments.

When Dr. Harkness died, I thought 1923, 1924 [December, 1923], Sir Arthur Currie, who, after all, remember, was a very distinguished military man and liked centralization, said: "There is not two different kinds of mathematic as I see it, there is only one." So he made one department under the chairmanship of Dr. Murray. And then Dr. [Charles Thomas] Sullivan — a very distinguished geometer, as you know, who was [here] so many years [1908–48], and did his best to make mathematics as easy as possible for unfortunate students — came over, transferred from Engineering to the Faculty of Arts, and

became Peter Redpath Professor of Mathematics. When Dr. Murray retired, in about 1928 or '29, Dr. Sullivan succeeded him. And he was Chairman, oh, until about 17 years ago[1].

Q: I was gonna say, after the war, because he was here and we ran a picture of him in the *McGill News* at the time he retired.

T: Now, in the early days, when I joined in 1921, the normal load of teaching in mathematics was 16 hours a week for members under the rank of Full Professor. Full Professors did 12. We had no offices. There was a general room in the Faculty of Arts and Science in the old Arts Building, with pigeonholes for our papers. It served as a Faculty room, it served as a combination room, and it also served as the Dean's office. The only person, in those days, speaking roughly, who had an office, was the Dean's secretary. I don't even know that the Dean had an office. I used to see him sitting at the head of the table in the Faculty room, and when he wanted a letter, he went into his secretary's office and dictated it there.

Well, that made it very difficult to carry on anything in the nature of research work, or sustained study, because in those days, the timetable was made up by the Dean's secretary, and all she was interested in was finding a place somewhere, and seeing a vacant space, and putting somebody in to lecture there. Consequently, we might have a lecture at 9 o'clock in the morning; the next might be at 1 o'clock in the afternoon, and the next at 5 o'clock in the evening. We had nowhere to go, we had nowhere to sit. The library was overcrowded and, as I say, you would go into the Faculty room, expecting to pick up your papers, you would find a Faculty meeting in progress, and you had to get out as quickly as possible.

Now, one of the greatest advantages that the staff had when the new Arts Building was made was that we had offices. And we were no longer lost sheep wandering from the library to the Faculty room, down to Murray's, spending too much time there drinking a cup of coffee, and in those ways, our whole time was frittered away. Then, due to the efforts of Professor [Stephen] Leacock, a new system of timetabling was introduced. Before this was introduced, some courses had four hours, some courses had two hours, and some courses had three hours. There was no uniformity. He introduced a uniform system of working in three-hour units. If your first lecture was at 9 on Monday, your next lecture was at 9 on

[1] He was at McGill from 1908 to 1946, but was replaced as Chair in 1945 by A.H.S. Gillson, who became President of the University of Manitoba in 1948.

Wednesday, and your next lecture was at 9 on Friday. And he firmly believed, and I think he persuaded all of us, that if you could not teach a course in three hours you either could not teach it at all or it was not worth teaching.

Q: I cannot think of anything more amusing, Professor Tate, than Professor Leacock with Miss Field. Because obviously, she must have been in charge of the timetable that you refer to, and I remember Miss Field as a tyrant in the Arts Building.

T: Yes, yes. Well, over the years, the next thing was, our hours at that time were reduced from 16 to 12 hours a week, and this reduction has gone on until today. I suppose, in the Mathematics Department, the average lecturing hours is about 8 hours a week, giving people time for reflection, proper preparation of lectures, for study and research.

4. Curriculum

Q: How about the actual curriculum itself? I suppose that expanded tremendously over the years.

T: The curriculum has expanded tremendously. When I came over in 1921, and frankly until about 18 years ago [1945–46], the undergraduate curriculum in mathematics consisted of 13 courses, almost all of them Honors courses. There was a big general course for first-year students, Mathematics 1. And there was a course for whom we considered the brighter students and who would eventually take Honors Mathematics 1A, 1 Advanced. Mathematics 1 consisted of all first-year students, roughly speaking, except about 15 or 16 who were in the first-year advanced course.

Now, after that, the advanced course, their future was clear. If they went on to Honors in Mathematics, they took courses 3 — famous calculus course — 4, 5, 6, up to Mathematics 11. But for the general students there was really nothing. There was a Mathematics 2, which really was a remedial course, which had to be offered in order to make teachers conform to the regulations of the Department of Education, and it was really meant to appeal to first-year students who were going in for education but who did not attain 65 % in their first year. Other general students who wished to take courses had to take the courses offered to the Honors students. Not many of them took it and very few of them survived. And it was not until the demand grew up from other departments to have courses tailored to

their requirements not on an Honors basis... For example, 25, 20 odd years ago, I introduced Elementary Calculus. That was when Professor Gillson was Chairman of the department. And he said: "Well, if we are willing to have this, if you could guarantee we would have 18 students or so." Well, we started off with 35 students; today there are 500 in that course.

Now, today, we offer over 30 courses in the undergraduate curriculum. We offer courses on the ordinary mathematics: analysis, calculus, advanced calculus. We also offer series of courses designed to meet the requirements of Honors students in chemistry; there is one course every year: first, second, third, and fourth year. The Department of Economics requires courses in statistics. We have courses in statistics, we have courses in actuarial mathematics, we have courses in group theory, which 20 years ago were regarded as being specifically for graduate students. In our graduate work, until about 18 or 19 years ago, we offered about six or seven courses in the Graduate School, most of which were never given. I would say that for about 20 years, up from 1921 up to about 1952, the number of graduate students we turned out in mathematics was only five or six… in 20 years.

Q: How does that compare with today? [1964]

T: Today, we have 40 students in the Graduate School alone each year, half of them Masters and half of them Doctors. Until Professor Gillson — and I succeeded him — took over, we had no Doctors candidates at all in mathematics. They all had to go elsewhere.

5. Creation of the Graduate School

[Q: Until 1945, Mathematics was almost wholly a service department with only seven faculty members. Can you say a few words about the creation of the Graduate School in Mathematics?]

T. When we decided to set up a Graduate School in Mathematics, I discussed the matter with Professor [Horace Noel] Fieldhouse, [a historian] who was Dean of the Faculty of Arts, and, of course, Doctor [Frank] James, who was Principal, and Doctor James told me: "Well," he asked me, "have you got a plan?" Well, I said: "I have a plan but it is not fully matured at the moment." "Well," he said, "come back to me when it is. We will discuss the things." So I discussed the matter with Dean Fieldhouse and Doctor James, both of whom gave us every possible encouragement and help. And we

decided that the best thing to build the Graduate School is from the top and not from the bottom. And we decided we would go out and get three or four really first-class mathematicians of a senior rank.

The first department hiring we made [in 1948] was Professor [Hans] Zassenhaus, who was a very world-famous algebraist and group theorist and whose work will probably be the foundation on these subjects for the next hundred years. He came in and developed our Graduate School and helped us enormously. And then Professor [Wacław] Kozakiewicz, a Pole from the University of Warsaw[2], who put our Statistical Section on a firm basis and who also was a very versatile analyst. And Professor [Charles] Fox, who is a remarkably versatile man who has written on practically every face of mathematics. And, of course, we have our present Chairman, Professor [Edward] Rosenthall, who was with us at that time and also is an expert in number theory. Without the help of these people, in fact, without these people, our Graduate School would never have even gotten off the ground. But from that day, it has never looked back and it is probably very, very well known today. Now, some of the... Oh, and I should mention, of course, in Theoretical Physics Professor Phil Wallace, whose section, really, was one of the brightest spots in the Mathematics Department.

6. Successful Students and Other Graduates

Q: Do you remember many of your students as outstanding, as brilliant students? Have you seen how they progressed in life?

T: Yes, all my students are outstanding, in one respect or another. In fact, there are so many of them that it is invidious to mention by name. There is [the interviewer] Mr. Lorne Gales, for example [chuckle]. Graham Glasgow, whom you all know, was a member of perhaps the most brilliant class in commerce I have ever had. In the second-year commerce class, there were 90 students. And my difficulty that year was not to pass them, but to keep most of them out of the first class. He was one of them. There are many others as well.

Anston McKim was another student, and Ken Carter, who is... Isn't he head of the Taxation Committee?[3] And there were, at one time, four people who were the Senior Auditors of the provinces of

[2] He was previously affiliated with the Université de Montréal.

[3] The Royal Commission on Taxation, or Carter Commission, was appointed in 1962 by the Prime Minister of Canada, John Diefenbaker, to examine and to recommend improvements to the entire federal taxation system; it produced an influential 6-volume report in 1966.

Alberta, Ontario, and so on. Now, there is Walter Markham, who is President, and there is David Scott who is the Vice-President of, the Continental Life Insurance Company. And there is Arthur Weaver, who is Vice-President of the John Hancock Insurance Company in Boston. There is Vernon Lawson, I think, who is... You can check this. I think he is Vice-President of the Montreal Life. And there is Anderson — I have forgotten his Christian name — who also is there.

Q: You taught a lot of actuaries! [Paradoxically, there is now no actuarial program at McGill.]

T: I taught a great many actuaries. That has been my specialization. And another man is Roy Saunders, who is controller of the Imperial Life and may be even manager now.

Now, some of our graduates: these are not all members of our Graduate School, but they all took either primary or subsequent degrees in McGill. I mention Professor Louis Nirenberg, who is in the Mathematical Institute of New York and who is one of the most distinguished men living in differential equations. He received the Bôcher [Memorial] Prize two years ago [in 1959, actually] in mathematics from the American Mathematical Society, which is the blue ribbon of mathematics all over the world. I [also] mention Professor Raoul Bott, who started with us in Engineering, then went to the Carnegie Institute, where he graduated with the PhD in theoretical physics, and is now Professor of Pure Mathematics in Harvard at an extraordinary early age and is one of the five or six really outstanding topologists in the world.

Professor [Viktor] Linis, who is Head of the Department of Mathematics in the University of Ottawa; Professor Norman Smith, who is Head of the [Mathematics] Department at Sir George Williams College [now Concordia University, Montréal]; Professor Raymond Ayoub, who is Professor of Mathematics at Pennsylvania State University and who has just finished his commission for writing the definitive book on the analytical theory of numbers on behalf of the American Mathematical Society; Professor Norman Oler, who has just been appointed to the staff of the University of Pennsylvania; Professor George Cree in Alberta, and Professor [Donald] Betts, who is in Theoretical Physics in Alberta; and Professor [John David] Jackson, who was on our staff from the University of MIT for six or seven years and is now Professor of Physics at the University of Illinois, who is an extraordinary, able theoretical physicist and with Professor Wallace gave us tremendous appetence in our Department of Theoretical Physics.

7. On Women in Mathematics

Q: A number of years ago, Professor Tate, you sat in at a meeting of a committee that was studying the possible revision of the curriculum of the School of Commerce, and I was particularly struck by a statement that you made; two statements really. The first was a statement on what you thought of the importance of extra-curricular activities among students. The other statement, which I would like you to repeat again today, are your reflections on the difference between men and women as they advance in the study of mathematics. I wonder if you recall that latter statement.

T: I am afraid I don't.

Q: It was something to the effect that after the first couple of years, men and women, from a mathematics point of view, are just about the same, but after that — when came a little more of a philosophy of mathematics, I think it was — that the woman's mind seemed to differ. Admittedly, this is almost... this is 12–15 years ago you said that [i.e., around 1950].

T: Now, do you want to get me into trouble with my wife?

Q: No, this is just for amongst us boys at the moment. We cut the tape.

T: Yes...

Q: And on your thoughts on teaching them at McGill because you have taught an awful flock of them.

T: Well, women work harder than men. And they are more conscientious than men. But, very often, a woman's thoughts are on something else. And there are — we have had — very, very good women in mathematics; we have had quite brilliant women in mathematics. But I think, speaking by and large, they have never reached the top heights, which men reach. Because of course they haven't got the spar of ambition. Now, many of our women have gone out to be married. They have done extremely

well, they have got Master's degrees, Doctor degrees, and then they go out to be married and that is the end of it.

As one former woman student of mine said, who was a very brilliant mathematician indeed in her early days in McGill — she was first in every year, and I met her a few years ago, she is married and she has had a couple of children; she married an engineer as a matter of fact — and she said: "When I married my husband, I knew far more mathematics than he did. After all," she said, "he was only an engineer!" But she said: "Today, I can hardly remember enough to make up my accounts! The reason is," she said, "I, in a busy life, I just simply have lost all my techniques and I haven't had time to keep them up."

Now, when a woman pursues her profession single-handed and single-mindedly, very often she does as well as any man and she has reached the first rank. There is one very well noted English woman mathematician, Miss [Mary] Cartwright, who is Mistress of — Head of — Girton College in Cambridge, an extremely well-known mathematician, and, of course, there have been others: Emmy Noether, a famous German mathematician, and so on. But as I say, after all, one of the things that they don't, and by and large, pursue is their mathematics once they have married. And, after all, that is the ultimate goal for most women.

8. Student Training and Mathematical Talent

Q: Professor Tate, there is one other interesting point. In 1961, when McGill submitted a brief to the Royal Commission on Education, one of the statements that was made in one section of the brief was the fact that the university was somewhat concerned over the fact that the young students coming along out of the high schools seemed to evade the more challenging subjects, and I think mathematics and physics were named. Have you any comment on that?

T: Well, it is very difficult to see how they can evade them because in effect they are compulsory in the first year!

Q: I think probably the point was being made about specializing or Honoring, or taking these on as their special course.

T: Yes, well, mathematical ability is quite rare. I mean outstanding mathematical ability is quite rare. Outstanding ability to write poetry is rare, outstanding musical ability is rare. And for that reason, the number of students who are really capable of doing advanced work in mathematics, at any time, is a very small proportion of the whole.

Q: I think what I'm getting at, really, is I wanted to get some comment from you about whether you thought that the students coming in were adequately prepared in these things on the lower level so that it gave you something to work with.

T: Well, we would all like students to be better prepared and we all are inclined to blame the other man for their defects. But I think that the students in Québec are as well prepared as they are anywhere on this continent. As a matter of fact, I had some experience of examining on the other side [in Europe] at Matriculation Level and I have been examining for the School Leaving Certificate in McGill — at least in McGill and in the Department of Education — for about forty years, and I must say that I would regard the average as good as anywhere in the British Empire, and probably better than most places in the [United] States.

Q: Do you think that one is born with mathematical ability or is it teaching?

T: Oh, undoubtedly. It is innate. It can be developed by teaching but if it is not there, you can't develop it. It is the same as music or art. You have to have the fundamental flare.

Q: You mean this is almost hereditary?

T: It is not hereditary. I would not say it is hereditary. But it is an inborn characteristic. It is like writing poetry. There are sports of nature; they occur, we do not know why they occur, we do not know why they occur in a particular family or at a particular time. But unless the man has the innate ability and liking to do mathematics — and, mind you, it is a self-absorbing and completely absorbing study — he can work his head off and he can make a progress up to a point, but he will never be outstanding.

Figure 1. The platform party before the closure of the ceremonies of the 1965 Convocation, May 28, 1965. Earle Wilcox Crampton and Herbert Tate in the foreground. Source: *The McGill News*/McGill University Archives, PR012236.

9. Closing Comments

Q: Professor Tate, I'm just gonna get personal for a moment. I know most faculty people have sort of given their lives over to teaching, and teaching has been their main hobby, their main profession. So I wondered whether you have had any other interests over the years.

T: Well, my main interests have always been teaching and my students. I was a cricketer at one time. I was a footballer at one time. But that's a long, long time ago. That's before I came to McGill.

Q: Now what are your plans immediately? You are still teaching, you have been on post-retirement teaching, and I wondered what you saw in the coming years.

T: At the present moment, I have no definite plans. I vaguely hope to do a lot of things, which I meant to do over the years and did not have time to do.

Q: Thank you very much, Professor Tate.

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