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THREE HUNDRED POUNDS OF INTEGRITY

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ABSTRACT. We discuss the life and work of a remarkable mathematician and teacher, Ben Fitzpatrick, Jr.

Ben Fitzpatrick, Jr., was our teacher and adviser at Auburn University, and our lifelong friend. He made lasting impressions upon our lives, as he did those of so many others. Nothing we can say or write can adequately portray this remarkable, gentle, special man. However, we want to remember him, and we want those who were not fortunate enough to know him to know a little about him. He died on November 11, 2000; the world is poorer for his passing.

We used many materials in the preparation of this article. In particular, we would like to thank Gary Gruenhage for his notes, and the Ben Fitzpatrick, Jr., Web site (www.benfitzpatrick.net).

1. His Life

Ben Fitzpatrick, Jr., was born in the September of 1932 in Miami, Florida. He was the second son of Ben and Frances Fitzpatrick. Ben's father was named for an ancestor, also Ben Fitzpatrick, who was the brother of Ben's great grandfather, served as both senator and governor of Alabama, and seceded Alabama from the Union. He was offerred a nomination for the vice presidency of the Confederacy in 1860, which he declined.

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Ben's only sibling, Daniel, is a retired veterinarian. Ben attended Auburn University (then known as Alabama Polytechnic Institute), where he majored in mathematics and graduated in 1952. During his one year as a graduate student at Auburn, he met and married Marjorie Higgins, a fellow student from northern Alabama. They were married for forty-seven years.

Ben and Margie left Auburn in 1953 and moved to Dallas, Texas. There they both worked for Chace Vought Aircraft, and their first child, Susan, arrived. In 1955, Ben began graduate school at the University of Texas in Austin. The family lived there for the next four years, and grew with the arrival of sons Jack and Kenneth. Ben wrote a thesis on a topic in differential equations under the direction of Professor H. J. Ettlinger and received his Ph.D. in 1958. Both Margie and Ben took courses from the legendary R. L. Moore at the University of Texas. Most of Ben's subsequent mathematical work has been in topology, the direction in which Moore started him. Ben was a descendant of E. H. Moore through both the R. L. Moore and E. J. Ettlinger "lines": Ettlinger's adviser was Garrett Birkhoff, and Birkhoff's adviser was E. H. Moore. On the R. L. Moore side, Moore's adviser was O. Veblen, whose adviser was also E. H. Moore.

In 1959, the Fitzpatrick family returned to Auburn, with Ben an assistant professor and Margie an instructor in the Mathematics Department. W. V. Parker, who had taught both Ben and Margie earlier, and was a respected teacher and administrator, was chair of the Department. (Parker went on to serve as Dean of Graduate Studies at Auburn.) Margie continued her studies at Auburn, and received her Ph.D. in 1964 under the direction of Emilie Haynsworth, an outstanding researcher in linear algebra. Margie was Emilie's first graduate student.

Ben served as a faculty member at Auburn from 1959 to 1982. Always a natural leader, Ben served as Department chair during the seventies and eighties. However, Ben's true calling was always his teaching. "Those of us who studied under him, as freshman calculus students or as graduate students engaged in their first research, always enjoyed his intellect, his good humor, his amazing ability to know when to prod and when to praise."[1]

Ben enjoyed travelling, and took advantage of those opportunities when they arose in connection with being a faculty member. He had extended visits to Egypt, England, and China. Many lasting friendships and collegial relationships were formed through these travels. Ben retired from Auburn in 1992, and he and Margie moved to San Antonio, Texas. Ben served there on the faculty of the University of the Incarnate Word from 1992 to 1996.

During the last years of his life, he was instrumental, with Harry Lucas, in starting the Legacy of R. L. Moore project at the University of Texas. This extensive project is concerned both with preserving a history of Moore, and with renewing interest in his method of teaching mathematics and modified versions of that method. As part of the project, Ben helped arrange conferences and conducted videotaped interviews of Moore students, and collected documents and photos.

Ben was a man who loved his family, loved teaching and his students, and loved mathematics. He read voraciously and widely; his house on Green Street was lined floor to ceiling with overflowing bookcases in nearly all its rooms. He liked old movies. He was an acute observer of human beings; he especially enjoyed the interesting ones, those with little quirks.

Ben also loved having a good time - more on that later.

2. Ben's Teaching

Even in grade school, Ben demonstrated a flair for teaching. His brother Daniel tells a story of Ben's difficulties enduring a math teacher whose abilities weren't the greatest when Ben was 12. After Ben had corrected her several times during a class period, she asked, "Young man, would you like to teach this class?" He replied, "Don't mind if I do", and headed for the board. However, instead of beginning his teaching career, he was sent to the principal's office. His mother later asked why he couldn't keep quiet. Ben replied that he just couldn't allow the teacher to tell the students all that wrong stuff.

[1]This is from the Ben Fitzpatrick, Jr., Web site. In fact, much of the material in this section came from that site.

This wonderful sketch of Ben captures his spirit so well. No one seems to know the identity of the Auburn student who did it. Ben often wore Guayabera shirts, as he is in both the sketch and the photo on the next page.

In Ben's classes, it was very clear which person was the professor: To us, he was "Professor Fitzpatrick" or "Dr. Fitzpatrick", and to him we were "Miss Kennedy" and "Mr. Reed". The use of titles was not an empty formality. Calling his students "Miss", "Mr." or "Mrs." signified that he considered them to be adults, deserving of the respect and responsibilities that came with adulthood. He was the teacher, the one with the expertise, and he was there to impart some of that to us. After we graduated, he began using our first names and expected us to call him "Ben", in return. Calling Professor Fitzpatrick "Ben" was difficult at first. It took one Miss Kennedy four whole years after getting her Ph.D. Finally, when riding back from an AMS meeting in Birmingham with Ben, he pleaded, "Would you *please* call me 'Ben'?" After that, Judy did.

Ben had a natural authority and dignity about him. He didn't have to say much to express exactly what he wanted. A certain look or a certain silence often did the job quite well. The words he

Ben with five of his students at the 1987 Spring Topology Conference at the University of Alabama in Birmingham. From left to right: Janet Rogers, Judy Kennedy, Mike Reed, Reg Traylor, Ben, John Bales. (Janet Rogers received a master's degree under Ben's direction.)

used were carefully chosen. He didn't praise his students very often, but when he did, it really meant something. He also used guilt and humor in his teaching. Mike gives us this example: A student in the class had been showing up late regularly and not doing much at the board. Ben commented that if this student couldn't arrive on time, he shouldn't come at all. During the class the tardy student put up a completely correct solution to a difficult problem, one that the class had been stuck on. At the end of class, Ben then commented, "Well, what time would you like to have class tomorrow, Mr. X?"

Describing what it was like to be in Professor Fitzpatrick's class is difficult. Of course, the experience varied with each student. For his lower level undergraduate classes, Ben's style was his own version of the standard lecture type class. Even in the lower level classes, however, "bonus" problems were posed. These were problems that required real thought and application of, say calculus, to solve, rather than just the obvious routine methods. His graduate classes were conducted Moore style, most often: On the first day of class, a list of definitions, problems, lemmas, exercises, theorems, and questions was given to the students. The job of the students was to go home and work through as much of this list as they could, providing proofs, solutions, answers as appropriate. Students were not to use books, other notes, or ask anyone for solutions. All work was to be their own. Upon returning to class, students were called on to present their work at the board and to be able to defend their work upon questioning by their fellow students and by the professor. As time passed and some students were more successful than others, those given the first opportunity to present their work were the less successful students (so that they had first crack at the easier problems). As the need arose, the list of theorems to prove, problems to solve, etc., was extended. By *not* giving one long exhaustive list of work to be done on the first day of class, Ben was able to adjust the work assigned to what was being done in class. If the class needed more hints or smaller steps, these could be included as lemmas or propositions in the list. If the class was moving quickly, more "big" results could be given, or additional avenues of study explored. Occasionally, Ben gave small lectures to explain an idea or give examples. Listening to his students and understanding what his students were doing and thinking drove to a large extent what Ben said and did, and drove the work assigned. Long inelegant proofs were endured: the point was teaching us to think for ourselves, not instantly being able to produce an elegant result. Incorrect proofs were endured: it was the job of the other students to question the presenter and to find any errors. Ben only stepped in if this did not work. We often learned more from those long, inelegant proofs and errors than we ever would have from seeing a neat, elegant result. A deep understanding of the ideas and relationships involved resulted from our own hard work and from seeing the efforts of our fellow students. Competition indeed played a role in motivating the students, but it was quite friendly. We learned from the successes and mistakes of our classmates as well as our own. We respected our fellow students and in many cases formed lifelong friendships.

We knew we trusted and respected this man. We cared deeply what he thought about us. Mitchell Anderson, a student in one of Ben's last topology classes, wrote the following:

Everyone knew Paul Stallings felt more at home in Euclidean space than anywhere else and [was] just filling time and credits in the class. One day Paul was at the board trying to show a certain space satisfied Axiom CM. As usual, he was shooting from the hip and this time he was stuck, big time. “Well, in any reasonable space this is certainly true”. We were all getting a bit nervous and I kept looking back at Ben to see how he was taking this continuous affront to point-set topology. “Well, in any reasonable space...*Mr. Stallings, are you trying to tell me that sequence is monotonically decreasing with my patience*?!!!” Although at the time I was looking for a hole to crawl in, one far from Mr. Stallings and Ben’s wrath, this was surely a typical day in class. Paul simply ignored the rough treatment and struggled along for another five minutes before finally getting the hint and sitting down. He never did keep his wits about him and worry about what Ben thought. Indeed, one day we got so out of control (yes, I had trouble being serious at times also) that Ben asked us if this was Junior High and did he need to separate us. What a bunch of buffoons we were!

I always take the long and boring way around a problem...except for Theorem 8, which I had so much time to think about that I finally gave an elegant proof. Mr. Darji just loved to pick on my efforts, or jump in at a moment’s notice (don’t get me wrong, Udayan [Darji] and I were as close as friends can get). Indeed, one day I got stuck on a problem while at the board, one which Udayan hadn’t given a second thought to or any effort on, and when I sat down he jumped in. I still can’t believe I was so wrapped up in myself as to stomp out of the room and slam the door...but that’s another story...also different from the time I spent six hours at the board trying to show an arc is an arc, only to have Ben turn to Udayan at the end and ask “Well,

> Mr. Darji, was that OK?" On this particular day I was at the board proving something about continuum theory. I must have been up there for most of an hour and was very proud of my ingenuity in solving what I thought was a complicated problem. When I was through, Ben asked if there were any questions and Udayan came up with : "Couldn't you just have used Theorem 30?" Needless to say, he used up all the air in my balloon. The next class meeting found Udayan at the board for the good part of an hour (a very long time for him). He labored for some time and was very disconcerted to see me squirming in my chair... usually I took little or no notice of his doings at the board. When Ben asked for questions I returned a well justified "Couldn't you have used Theorem 30?" Ben's response... "A little tit for tat" and a nice big smile.[2]

Austin French sent this letter to Ben on the occasion of Ben's retirement. Fortunately, he sent Mike Reed a copy. If he hadn't, Ben probably never would have shared it. Ben was never one for tooting his own horn. Austin French was in the same class as Mike Reed, and completed his Ph.D. in a record two years after coming to Auburn. His thesis came from a question he answered at the board when he showed an entirely new equivalence in dimension theory.

> Dear Dr. Fitzpatrick,
>
> I am so sorry that I will not be able to be at Mike Reed's colloquium and your retirement party June 5. On that day Belinda and I have our 25th wedding anniversary.
>
> I want to express to you my deep appreciation for the good you have done in my life. There is no way I could pay you back.
>
> I feel like the word integrity was invented for you. When I was at Auburn, my fellow students and I hung on your every word. That respect for you has

[2]To this day, many of us know the big theorems by the numbers they were assigned in our sequence rather than by their names.

> not changed. Even though I tried a few times, at your urging, to call you Ben, it would just never come out right. For me you are forever Dr. Fitzpatrick with all the respect that title deserves.
>
> I appreciate how unbelievably hard you made your courses and how fair you are. That is a way of being kind to people and helping them that is not appreciated enough today. That leads me to the following point...
>
> Do you think now after all these years you could forgive Mike Reed for giving me a hint while at the board where for two consecutive days I was being laughed out of class for the stupid things I was saying? I remember your exhortation.. "Mr. Reed, your lot in life is not to make life easier on Mr. French at the board." "Mr. Reed" saved this boy from the pit. Enough nostalgia.
>
> Most of all I want to thank you for seeing in me something I would not have seen within myself in a hundred lifetimes. I thank God for your good influence on my life. I continue to reap a good harvest from fields I did not plow.
>
> Gratefully yours,
> Austin French

Ben directed 21 Ph.D. theses and 33 M.S. theses. In a letter to Mike Reed about his Ph.D. students, Ben wrote the following:

> Most, if not all, of my students actually had very little *if any* guidance during the preparation of their Ph.D. theses. Sometimes I would point them in the general direction of a problem; sometimes a topic would arise naturally in seminars, sometimes I had not even this much to do with their selection of a topic. In any event, they all formulated the problem precisely and developed their solution. They have all taught me a great deal of mathematics and much more about life.
>
> In **A Mathematician's Apology**, G. H. Hardy wrote that his mathematical researches were the one

> great permanent happiness of his life. Aside from my family, the greatest happiness of my life has been my students.

We end this section with a list of Ben's Ph.D. students, grouped according to interest:

- **Moore spaces**: D. Reginald Traylor (1962), Kenneth E. Whipple (1964), James W. Ott (1969), George Michael Reed (1971).
- **Dimension theory**: Ralph M. Ford (1963), J. Austin French (1969), H. Kermit Smith (1972).
- **Lasnev spaces**: Kenneth R. van Doren (1972).
- **Homogeneity**: Norma F. Lauer (1974), Judy A. Kennedy (1975), John W. Bales (1975), J. M. Stephen White (1976), William L. Saltsman (1989), Zhanbo Yang (1989).
- **Numerical analysis**: C. S. Frady (1966).
- **Collectionwise normality**: Arthur R. van Cleave (1968).
- **Infinite-dimensional topology**: David M. Hancasky (1971).
- **Convexity in topology**: Douglas L. Moreman (1973).
- **Topology without points**: N. O. Williams (1972).
- **General systems theory**: Y. (Jeffrey) Lin (1988).
- **Continuum theory**: Jo Heath (1964).

3. Building the community

By publishing in *Fundamenta Mathematicae* and other topology journals, Ben and other Auburn faculty members (most of whom had come to Auburn because of Ben), began to put Auburn University on the world topological map. Then began a series of visits from Eastern European topologists, as well as those from other universities in the U.S. Auburn had a weekly Friday afternoon colloquium series, which was well attended by faculty and graduate students, and gave visiting mathematicians a venue for their work. Afterwards there would be a party at someone's house in honor of the speaker. During the later years of the cold war and after, one- or two-year visiting positions taken by active young topologists from all over the world, but in particular from Poland, gave these mathematicians a chance to get to know those at Auburn and vice versa. Auburn University became, over the years, one of the international centers for point set topology. These activities also helped re-establish U.S.-Polish, US-Russian, and (after Ben's China trip) US-Chinese mathematical relations as the cold war thawed and then ended. Ben and Margie's year in China literally re-opened China topologically. During that year, Ben made a number of lasting friendships. A number of Chinese graduate students came to Auburn as a result of that trip. Two of them are among Ben's last graduate students.

Ben was one of the topologists who helped establish the annual Spring topology conference. The first was held at Arizona State University in 1967. That first conference was just a group of topologists who had decided that it would be good to get together and talk about what they were doing. But it was a success, and every year since the conference has been held in the spring. Over the years it has grown to include more areas of topology and the mathematics that uses topology. Eventually NSF funding was applied for and usually obtained.

During the first years, each conference host institution was responsible for publishing a proceedings for the conference. This was a problematic arrangement, however. In the early seventies, with Ben's prodding Auburn University decided to take over the proceedings on a permanent basis. Donna Bennett was hired as managing editor, and remained in that position until she retired just this past summer (2001). The publication named appropriately, *Topology Proceedings*, was available to conference attendees at a very economical price. Even though priced to buy, it made money, and became a real refereed journal, rather than just a conference proceedings. Today *Topology Proceedings* encompasses the proceedings of the Summer Topology Conference as well as the Spring. Two volumes per year are published, with one volume dedicated to each conference.

4. Ben's mathematics

During his career, between 1965 and 1994 Ben produced eighteen papers, including two surveys and one history paper, and edited a volume of *Topology and Applications* with R. Sher [RS]. The edited volume was produced in honor of Ben's long-time friend, B. J. Ball, of the University of Georgia. The papers Ben wrote can be divided into the categories as follows:

- homogeneity (7 papers, 2 of which were surveys),
- Moore spaces (3 papers),
- topological completions (3 papers),
- inverse limits (one paper),
- dimension theory (one paper),
- continuum theory (two papers), and
- history (one paper).

4.1. **Homogeneity.** To paraphrase the first paragraph of [FZ3], the study of homogeneity properties and the relations between them in the presence or absence of other, standard topological properties is a complex, rich family of relationships, and some seemingly innocent questions are not easily answered. Countable dense homogeneity was introduced by Ralph Bennett in 1971. A separable topological space X is *countable dense homogeneous* if for each pair A and B of countable dense subsets of X, there is a homeomorphism f from X onto itself such that $f(A) = B$. Examples of countable dense homogeneous spaces include Euclidean space $\mathbf{R}^n$ for each positive integer n, the irrationals, and the Hilbert cube. In [F1] Ben proved this elegant theorem: if X is a countable dense homogeneous, connected, locally compact, metric space, then X is locally connected.

Related ideas are those of dense homogeneity and representability: The space X is *densely homogeneous* if for every σ-discrete dense pair A, B of subsets of X, there is a homeomorphism $h : X \to X$ such that $h(A) = B$. The space X is *representable* if whenever the point p is an element of the open set U, then there is an open set V in X such that $p \in V \subset U$ and such that, if $q \in V$ there is a homeomorphism h from X to itself such that $h(p) = q$ and h is the identity on $X \backslash U$. Papers with coauthors Norma Lauer, Zhou Hao Xuan, and Steve White investigated dense homogeneity and countable dense homogeneity. Notable results from those papers include the following:

(1): In [FL], Ben and Norma Lauer (one of Ben's students) showed that every nontrivial component of a metric densely homogeneous space is open. (In 1987, Ben's student, W. Saltsman [S] extended this result to nonmetric spaces.)

(2): In [FZ2] and [FWZ] it was shown that there is an example of a Moore manifold that is countable dense homogeneous but not densely homogeneous, even with respect to homeomorphic σ-discrete dense sets.

(3): [FZ2] There is an example of a Hausdorff, connected, locally connected, countable dense homogeneous space which is not representable and which contains an open set u which is not countable dense homogeneous. (In 1992, Simon and Watson gave an example of a completely regular, connected, countable dense homogeneous space containing an open set u which is not countable dense homogeneous.)

(4): [FZ1] If the space X is a one-dimensional continuum, or X is a complete metric zero-dimensional space, then X is countable dense homogeneous implies that every open subset of X is countable dense homogeneous.

(5): [FZ1] A countable dense homogeneous, meager, metric space is a λ-set.

Two papers written with Zhou Hao Xuan, [FZ3] and [FZ4], surveyed homogeneity and posed open problems in dense homogeneity, respectively.

4.2. **Moore spaces.** If X is regular topological space, then a *development* for X is a sequence $G_1, G_2, G_3, \ldots$ of collections of open sets of X such that for each positive integer i,

(a): each G_i covers X,

(b): $G_{i+1} \subset G_i$, and

(c): if u is an open set and $x \in u$, then there is some positive integer m such that if $g \in G_m$ that contains x, then the closure $\overline{g}$ of g is contained in u.

The development $G_1, G_2, G_3, \ldots$ is a *complete development* if it has the property that if $d_1, d_2, \ldots$ is a sequence of closed sets such that for each n, (i) $d_n \supset d_{n+1}$, and (ii) there is a member g_n of G_n such that $\overline{g_n} \subset d_n$, then $\cap_{i=1}^{\infty} d_n \neq \emptyset$. A *Moore space* is a regular topological space which has a development; a *complete Moore space* is a Moore space which has a complete development. The Moore space X is *completable* if some complete Moore space contains it as a subspace.

Ben and D. R. Traylor investigated normal Moore spaces in a paper [FT] that appeared in 1966. They proved two things about those spaces: (1) If not every normal Moore space is metrizable, then some such space is locally metrizable at any point. (2) If there is a normal, separable, nonmetrizable Moore space, then there is one such space which is also locally compact.

In his first dense subspace paper [F1], Ben proved that every completable Moore space contains a dense metrizable subspace. He then used his results to give alternate proofs of some results of Mary Ellen Rudin [R] and Robert Heath [H].

A collection of closed sets is *discrete* if the members are mutually disjoint and any union of members of the collection is closed. A space is *collectionwise normal with respect to a discrete collection* $\mathcal{K}$ of closed sets if for each $K_\alpha \in \mathcal{K}$ there is an open set O_α containing K_α, and the collection $\mathcal{O} = \{O_\alpha : K_\alpha \in \mathcal{K}\}$ is mutually disjoint. The space X is a *counterexample of type* D if X is a normal Moore space, and X contains a discrete collection of points such that X is not collectionwise normal with respect to the collection. Bing [B] defined counterexample of type D and asked if the existence of a counterexample to the normal Moore space conjecture implies the existence of a counterexample of type D. In his second dense subspace paper [F2], Ben showed that if X is a normal Moore space which contains no dense metric subspace, then X is a counterexample of type D.[3]

4.3. **Topological completions.** At the 1970 Spring Topology Conference at Emory University, J. Nagata asked whether every topological space with a σ-locally finite basis (pseudo-basis) is the union of countably many closed metrizable subspaces, and whether every topological space which is not the image under a closed, continuous map of a metrizable space is such a countable union. He indicated that the questions would probably be answered in the negative. The question sparked Ben's interest, and, in [F4], Ben provided those negative answers and more. He proved that if X is either (1) a complete, nonmetrizable Moore space or (2) a certain topologically complete nonmetrizable space that is the closed continuous image of a separable complete metric space, then there exists a space Y with the same properties and in which every open set contains a copy of X, and Y satisfies the Baire category theorem. In the first case, Y is a first countable space which has a σ-locally finite

[3]Since this time, the question of whether every normal Moore space is metrizable has been extensively studied and largely settled. It turned out to be a consistency result: the answer depends upon the set theoretic axioms assumed.

network but is not the union of countably many closed metrizable subspaces. In the second case, Y is the closed, continuous image of a metrizable space which is not such a countable union.

The next completion paper [FGO], written with Gary Gruenhage and James Ott, appeared in 1993. For X, Y metric spaces, X is a *completion remainder* of Y if there is a completion $c(Y)$ of Y such that X is homeomorphic to $c(Y)\backslash Y$. Let $CR(Y)$ denote the class of completion remainders of Y. For example, Y is a separable metric locally compact non-compact space implies $CR(Y)$ is the class of all Polish spaces. (*Polish spaces* are complete, separable metric spaces.) For the case where X and Y are complete metric spaces, necessary and sufficient conditions were given in the paper for X to be a completion remainder of Y ($X \in CR(Y)$). The paper also characterized the completion remainders of the reals $\mathbf{R}$, and the rationals $\mathbf{Q}$.

The paper written by Zhou Hao Xuan in 1994 [FZ4] continued this investigation of completions and completion remainders. The paper characterized the completion remainders of the irrationals $\mathbf{P}$, a study began in [FGO]. The main result of the paper was that a separable metric space X is in $CR(P)$ if and only if X is rim-complete and is the difference of two complete spaces. (A space is *rim-complete* if it has a basis each element of which has a complete boundary.)

4.4. **Inverse limits.** In a paper that appeared in 1948, Katetov [K] proved that countable products of perfectly normal spaces need not be perfectly normal, but he also proved the following theorem: if for each positive integer i, X_i is a space and, for each n, the finite product $\prod_{i=1}^{n} X_i$ is perfectly normal, then the countable product $\prod_{i=1}^{\infty} X_i$ is perfectly normal. Ben and Howard Cook [CF], in a paper that appeared in 1968, proved that (countable) inverse limits of perfectly normal spaces are perfectly normal. They then investigated the consequences of this fact for Moore spaces and gave an alternate proof of a result of D. R. Traylor [T].

4.5. **Dimension theory.** Ben wrote, with Ralph Ford, one paper on dimension theory [FF]. Morita [M] had proved that small and large inductive dimension are equivalent under certain conditions; specifically, $ind\, X = Ind\, X$ if X is strongly paracompact and metric. Ralph Ford [F] had proved that $ind\, X = Ind\, X$ if X is totally paracompact and metric. The classes of strongly paracompact spaces and totally paracompact spaces intersect, but neither is a subset of the other. Fitzpatrick and Ford defined a new notion, order total paracompactness, and proved that $ind\, X = Ind\, X$ if X is order totally paracompact and metric. (The space X is *totally paracompact* if every basis for X has a locally finite subcollection covering. The space X is *order totally paracompact* if whenever G is a basis for X, there is an ordered collection $(H, <)$ of open sets covering X such that (i) if $h \in H$, there is an element g of G such that $h \subset g$ and $\partial h \subset \partial g$ (where ∂h denotes the boundary of h), and (ii) if $h \in H$, then the collection of all elements of H preceding h is locally finite at each point of h.)

4.6. **Continuum theory.** A space X is *Suslinean* if it has no uncountable disjoint collection of subcontinua. This idea had been investigated by A. Lelek and H. Cook ([L1], [L2], [CL]). Ben and A. Lelek continued the study of Suslinean spaces in [FL], the main results of which are the following:

- **(1):** If the space X is an atriodic Suslinean continuum, then the set of points of X at which it is locally connected is dense in X.
- **(2):** If X is a Suslinean continuum, then the set of points of X at which it is connected im kleinen is dense in X.
- **(3):** There exists a nondegenerate rational dendroid X in the plane such that each nonempty connected open subset of X is dense in X; hence, the set of points of X at which it is connected im kleinen is empty.

Let $\mathcal{K}$ denote the class of all compact metric continua K such that there exists a continuous mapping from a compact metric irreducible continuum M onto an arc such that each point inverse is homeomorphic to K. In the paper Ben wrote with coauthors J. W. Hinrichsen and W. R. R. Transue [TFH], the main result proved that no connected 1-polyhedron other than an arc is an element of $\mathcal{K}$. A result of Ben in the paper was that there exists a compact locally connected continuum M which is not an arc and which is a member of $\mathcal{K}$. Hinrichsen showed that the arc is the only connected finite 1-polyhedron which is a member of $\mathcal{K}$. Transue proved that a simple closed curve is not in $\mathcal{K}$.

4.7. **History.** The last paper Ben published was devoted to the work of R. L. Moore [F5]. (Ben had begun an extensive study of the mathematical descendants of R. L. Moore at the time of his death, but that work was not finished.) To quote reviewer Albert Lewis, "The author has succeeded in providing new insights into Robert Lee Moore, his influence on mathematics and on the teaching of mathematics." Ben's work on Moore meshed quite well with the Legacy of R. L. Moore project in which he was deeply involved.

5. Ben, the 'party animal'

Often talking with other mathematicians, many stories are heard about how they *survived* graduate school. The graduate experience at Auburn was not like that - we worked hard, but we played hard, too. Ben loved a good party with his friends. The social life of the Auburn Math Department during the years of Ben's tenure was incredibly rich, and much of it included the graduate students, who were regarded as apprentice professors. Those of us who were graduate students then remember it with nothing short of wonder - as Mike Reed says, it was our own "Camelot". In addition to parties after the Friday afternoon colloquium talks of visitors, there were get-togethers known as War Eagles on the remaining Friday afternoons while school was in session. Probably the name came from the old War Eagle Supper Club on the outskirts of Auburn where these get-togethers were held until it got so delapidated and finally closed. Anyone in the mood would go, drink beer, talk, and have pizza.

There were also the fall and spring Gold Hill picnics, held on a weekend day out at Miss Emilie's (Haynsworth) home or the old Baskerville house (while Ben and Margie lived there). These began at 3 p.m. or so, children and dogs were included, everyone brought a dish while soft drinks and kegs of beer were provided, there would be an afternoon football game, and they went on until the last stragglers left after dark and the singing around the picnic table ended. Someone always brought a guitar for accompaniment. We remember fondly all the times we sang "Good night, Irene", "Will the circle be unbroken", and many other old favorites. Another annual spring event was the San Jacinto Day celebration held outside at the Coleman home. Various members of the Department contributed their wonderful Tex-Mex specialties (Ben's was his super hot chili) and there would be a piñata for the children.

And then there was the Okie Transfer Company, named for an old pick-up someone in the department owned. Anyone moving locally would post a notice in the coffee room of the department stating time and places for the move. Department members free at that time would show up with their pick-ups or station wagons (if they had them) and help with the moving process. In return, the person moving would provide lots of beer and soft drinks for the helpers. Ben would be there in his overalls, helping move the big, heavy items. Moving was accomplished quickly and efficiently, and was fun, besides. We even had our own "uniform" - a t-shirt with a group portrait including the pick-up.

Each year, the Department would rent a university van to transport the large number of topologists to the Annual Spring Topology Conference. The van, loaded with topologists, their bags, and a cooler filled with sandwiches, soft drinks, and beer, took off and drove straight through to the conference with Ben at the wheel. (Ben really didn't like for anyone else to drive, and only gave up the wheel when extreme exhaustion forced it.) This often meant driving through the night, but it was *so* much fun. At the conference, Ben and Bill Mahavier (Ben's good friend from graduate school who is now retired from being a professor at Emory University) maintained a "hospitality suite", which was just one of their rooms lavishly stocked with refreshments. During the conference, old friends, former students, etc., would be invited to the room to do some serious catching up on respective lives and friends.

Thank you, Ben, for enriching our lives and for so many wonderful memories.

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