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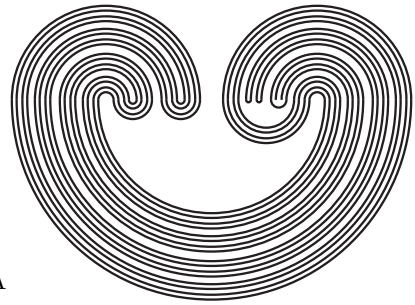

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F. BURTON JONES (1910-1999) – AN APPRECIATION

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1. F. Burton Jones (1910-1999) – An Appreciation

F. Burton Jones died on April 15, 1999, at the Vista del Monte Retirement Facility in Santa Barbara, California. He and Madeleine, his wife of 63 years, had resided there since 1992. In addition to his wife, he is survived by three children, Marian Silva, Clay Jones and Lesley Jones, five grandsons and two great granddaughters.

Jones was born in Cisco, Texas, on November 22, 1910. His father, a pharmacist, was also a local politician, serving in various positions in Shackelford County, Texas. As a result, Jones was thrown into contact with lots of lawyers during his teens and first aspired to be one himself. Since he was valedictorian of his high school class, he qualified for a Regents' Scholarship to the University of Texas, where he started the pre-law program.

Jones soon discovered a problem; he had a poor memory, especially for dates and history. He switched his major to chemistry, but he took math courses, more than just those necessary for a science major. In the beginning calculus course, Jones came under the influence of R. L. Moore. When Jones graduated in chemistry in 1932, Moore offered him a part time job as a math instructor. Jobs were scarce, and Jones accepted

the offer. He received his doctorate in mathematics from the University of Texas in 1935.

Jones was a member of the faculty at the University of Texas from 1935 until 1950, except for the years of World War II. During those years (1942–44), he was a Research Associate at the Harvard Underwater Sound Laboratory. There he was part of a six-man team that developed scanning sonar for the Navy.

In 1950 Jones left the University of Texas to accept a position at the University of North Carolina. There he directed five Ph.D. dissertations and chaired the Department of Mathematics. In 1962 he moved to the University of California at Riverside, where he helped launch the doctoral program in mathematics and directed 10 more Ph.D. dissertations. He remained there until his retirement in 1978.

2. F. Burton Jones – The Teacher

Later I will discuss Jones' research contributions, but, as brilliant as Jones' research was, it was overshadowed by his great skill as a teacher and his worth as a human being. In fact, his main interest was teaching and introducing mathematics to the upcoming generation.

Jones' method of teaching was a modification of the "Moore method." He believed in "learning by doing," although he incorporated textbooks into his courses. Jones would start his graduate course in topology with a sequence of definitions and statements of theorems. He adopted an axiom system in which some familiar theorems were false. Pretty soon he had everybody's attention, and then he (or perhaps the students) would strengthen the axiom to make the familiar situation return. Around Christmas he would assign Kelley's topology book to be read outside of class. By then there was little overlap between the course and the book.

Louis McAuley, in a 1969 tribute to Jones, writes of "the magical powers of Jones in the classroom–a master–who breathes

the very life of mathematics into his students." These remarks would be echoed by those who had the good fortune to sit in Jones' class.

Others remember Jones as a source of encouragement and of knowledge about problems. His role was sometimes that of the kindly uncle, who moderated differences between those trained in the Moore school and those of other persuasions.

In 1987 he and Madeleine endowed the F. Burton Jones Chair in Topology at the University of California at Riverside. Their generosity ensures that one of the most respected members of our topological community will be permanently recognized at UCR.

3. F. Burton Jones – The Research

I will confine myself to four of Jones' results from early in his career, results that had an enormous impact on the development of point set topology and continuum theory in the last half of the twentieth century.

Jones and the normal Moore space problem. I think this was Jones' most important paper (and I'm a continuum theorist!). Jones essentially wrote only one major paper on metrization, but it had immense consequences. R. L. Moore had developed a series of axioms in his Foundations book to yield what became known as a Moore space. As Jones recalled it, he became interested in the problem of metrization of Moore spaces after reading a paper of J. H. Roberts. Roberts wanted certain Moore spaces to be metrizable, but Jones showed they weren't because they were not normal. But what if a Moore space were normal; would it be metrizable?

In 1937 Jones published a result [3] he had obtained four years earlier: a separable, normal Moore space is metrizable provided $2^{\aleph_1} > 2^{\aleph_0}$. He also raised the normal Moore space problem: Is every normal Moore space metrizable? Attempts to answer this question have resulted in literally hundreds of

papers in topology, and Jones' result itself is only the first of many papers to introduce axiomatic set theory into what appears to be a general topology problem. The answer, incidentally, is independent of Zermelo–Fraenkel set theory, a fact that makes Jones' set theoretic assumption even more remarkable.

Jones and Moore's Axiom 5. This has my nomination as Jones' most amazing paper. In 1938 Jones published a paper [4] in which he showed that if the phrase "simple closed curve" in Axiom 5 of Moore's Foundations was replaced by the phrase "compact continuum," then the first four axioms plus the weakened Axiom 5 implied the original Axiom 5. In the revised edition of Foundations, published in 1962, Moore replaced the original Axiom 5 with the modified version of Jones and commented that this change was a major one. Indeed, it was quite a coup to weaken the axiom so dramatically. I can hardly imagine being so bold as to dream this was possible.

Jones and homogeneity. This is my favorite Jones' paper. Jones proved a beautiful theorem about homogeneous continua. I call it the Jones' Aposyndetic Decomposition Theorem, and it goes like this:

Let x be a point of a continuum M, and let L_x be the set consisting of x together with all points z of M such that M is not aposyndetic at z with respect to x. The collection of all such L_x's forms a very clever continuous decomposition of a homogeneous decomposable continuum M as follows:

Jones' Aposyndetic Decomposition Theorem. Suppose that M is a decomposable, homogeneous continuum. Then there exists a nondegenerate collection G of mutually exclusive continua filling up M such that

(a) the decomposition space N is a homogeneous, aposyndetic continuum,
(b) if x is a point of M, then L_x is an element of G,

(c) if g is an element of G and K is a subcontinuum of M that contains both a point of g and a point of $M - g$, then g is a subset of K,
(d) the associated quotient mapping $\pi : M \to N$ is a monotone, open map, and
(e) if g is an element of G, then g is a homogeneous continuum.

This theorem is an irresistible invitation to construct a circle of pseudoarcs, which Bing and Jones did only a short time later. Other homogeneous curves had their points blown up to pseudoarcs over the next 30 years.

It is also clear that a version of the theorem for indecomposable continua should be true (consider the decomposition of a solenoid of pseudoarcs by maximal pseudoarcs), but it was over 30 years later before this was accomplished.

Jones and Aposyndesis. I think this may have been Jones' favorite paper. Jones liked to tell the story of the origination of the word "aposyndetic." He was stimulated to discover the notion of an aposyndetic continuum by a talk of G. T. Whyburn in 1938. Whyburn talked about a generalization of local connected continua which he termed semi-locally-connected continua. Evidently Whyburn had considered the same notion some years earlier under the name "local divisibility," but for some reason gave up on that name.

Jones discovered the notion of aposyndesis, sort of a dual notion to Whyburn's concept, a few months later. He was determined to find a name for his concept that would stick! After lots of thought with little to show for it, Jones visited Dr. Leon in the Classics Department at the University of Texas. We can imagine the scene of Jones explaining to a scholar with little mathematics background this abstract notion. He must have done a pretty good job. "Apo" means "away from", "syn" means "together", and "deo" means "to bind". So the continuum M is aposyndetic at the point p with respect to

the point q means that M is bound together at p away from q. Formally, M is aposyndetic at p with respect to q if some subcontinuum of M contains p in its interior and does not contain q.

The concept of aposyndesis and its development as a theory first saw print in 1941 [9]. It has been and continues to be a big hit with topologists, especially Jones' students. In 1980 a conference was held on the occasion of Jones' retirement. In the proceedings of that conference, Ned Grace compiled a bibliography of aposyndesis. It contained 217 items! Such a bibliography today would include several hundred more references.

4. Curriculum Vitae – F. Burton Jones

Education: 1932, B.A., Chemistry, University of Texas, Austin, Texas
1935, Ph.D., Mathematics, University of Texas, Austin, Texas

Professional Experience:

Jan.-June 1982	Distinguished Visiting Scientist, Department of Mathematics, Auburn University, Auburn, Alabama
June 1982- June 1978	Professor Emeritus, Department of Mathematics University of California, Riverside, California
Sept. 1962- June 1978	Professor, Department of Mathematics University of California, Riverside, California
Summers 1959, 1962	Visiting Professor, Department of Mathematics University of Colorado, Boulder, Colorado

Summers 1956, 1957, 1961	Visiting Professor, Department of Mathematics University of Wisconsin
Sept. 1950- Sept. 1962	Professor, Department of Mathematics University of North Carolina, Chapel Hill, North Carolina
Sept. 1943- Sept. 1950	Associate Professor, Department of Mathematics University of Texas, Austin, Texas
May 1942- Oct. 1944	Research Associate (Anti-submarine warfare) Harvard University (On leave from Univ. of Texas)
Sept. 1940- Sept. 1943	Assistant Professor, Department of Mathematics University of Texas, Austin, Texas
Sept. 1935- Sept. 1940	Instructor, Department of Mathematics University of Texas, Austin, Texas
Sept. 1932- June 1935	Part-time Instructor, Department of Mathematics University of Texas, Austin, Texas

Honors and Awards:

1957-58	NSF Sr. Postdoctoral Fellowship Member, Institute for Advanced Study, Princeton, NJ
1968	Visiting Fellow, Institute for Advanced Studies, Australian National University, Canberra, Australia
1975	Fulbright-Hays Fellow, Canterbury University, Christchurch, New Zealand
Summers	National Academy of Sciences Exchange Program
1971	Czechoslovakia
1975	Poland

Ph.D. Students of F. Burton Jones

1. McAuley, L. F., University of North Carolina, 1954
2. Smith, Marion B., University of North Carolina, 1957
3. Grace, E. E., University of North Carolina, 1957
4. Heath, Robert W., University of North Carolina, 1959
5. Roy, Prabir, University of North Carolina, 1962
6. Thomas, Edward Sandusky, Jr., Univ. of California, Riverside, 1965
7. Gref, Lynn George, Univ. of California, Riverside, 1966
8. Arnquist, Clifford W., Univ. of California, Riverside, 1967
9. Vought, Eldon Jon, Univ. of California, Riverside, 1967
10. Rogers, James Ted, Jr., Univ. of California, Riverside,1968
11. Shirley, Edward D., Univ. of California, Riverside, 1969
12. Rogers, Leland Edward, Univ. of California, Riverside, 1970
13. Gordh, George Rudolph, Univ. of California, Riverside, 1971
14. Fox, Don, Univ. of California, Riverside, 1973
15. Graham, Barry, Univ. of California, Riverside, 1977

Publications of F. Burton Jones

[1] *A theorem concerning locally peripherally separable spaces*, Bull. Amer. Math. Soc., 41 (1935), 437–439.

[2] *Concerning certain topologically flat spaces*, Trans. Amer. Math. Soc., 42 (1937), 671–677.

[3] *Concerning normal and completely normal spaces*, Bull. Amer. Math. Soc., 43 (1937), 671–677.

[4] *Concerning R. L. Moore's Axiom 5*, Bull. Amer. Math. Soc., 44 (1938), 689–692.

[5] *Certain equivalences and subsets of a plane*, Duke Math. J., 5 (1939), 133–145.

[6] *Concerning the boundary of a complementary domain of a continuous curve*, Bull. Amer. Math. Soc., 45 (1939), 428–435.

[7] *Concerning certain linear abstract spaces and simple continuous curves*, Bull. Amer. Math. Soc., 45 (1939), 623–628.

[8] *Almost cyclic elements and simple links of a continuous curve*, Bull. Amer. Math. Soc., 46 (1940), 755–738.

[9] *Aposyndetic continua and certain boundary problems*, Amer. J. Math., 63 (1941), 545–553.

[10] *Certain consequences of the Jordan curve theorem*, Amer. J. Math., 63 (1941), 531–544.

[11] *Monotonic collections of peripherally separable connected domains*, Bull. Amer. Math. Soc., 47 (1941), 661–664.

[12] *Connected and disconnected plane sets and the functional equation* $f(x)+f(y) = f(x+y)$, Bull. Amer. Math. Soc., 48 (1942), 115–120.

[13] *Measures and other properties of a Hamel basis*, Bull. Amer. Math. Soc., 48 (1942), 472–481.

[14] *Concerning the separability of certain locally connected metric spaces*, Bull. Amer. Math. Soc., 52 (1946), 303–306.

[15] *A characterization of a semi-locally connected plane continuum*, Bull. Amer. Math. Soc., 53 (1947), 170–175.

[16] *Concerning non-aposyndetic continua*, Amer. J. Math., 60 (1948), 403–413.

[17] *A note on homogeneous plane continua*, Bull. Amer. Math. Soc., 55 (1949), 113–114.

[18] *On the design of networks for constant time delay*, J. App. Physics, 20 (1949), 615–620, with M. H. Hebb and C. W. Norton .

[19] *Certain homogeneous unicoherent indecomposable continua*, Proc. Amer. Math. Soc., 2 (1951), 855–859.

[20] *Concerning aposyndetic and non-aposyndetic continua*, Bull. Amer. Math. Soc., 58 (1952), 137–151. (This is the published text of his invited hour address given before the

American Mathematical Society in Boulder, Colorado on September 1, 1949.)

[21] *On the separation of the set of pairs of a set*, J. Elisha Mitchell Scientific Soc., 69 (1953), 137–151.

[22] *On certain well-ordered monotone collections of sets*, J. Elisha Mitchell Scientific Soc., 69 (1953), 30-34.

[23] *On a property related to separability in metric spaces*, J. Elisha Mitchell Scientific Soc., 70 (1954), 30-33.

[24] *Introductory remarks on semi-metric spaces*, Amer. Math. Soc. Summer Inst. for Set Theoretic Topology (1955), 58.

[25] *On homogeneity*, Amer. Math. Soc. Summer Inst. for Set Theoretic Topology (1955), 66–68.

[26] *Problems in the plane*, Amer. Math. Soc. Summer Inst. for Set Theoretic Topology (1955), 68–70.

[27] *On a certain type of homogeneous plane continuum*, Proc. Amer. Math. Soc., 6 (1955), 735–740.

[28] *On the existence of weak cutpoints in plane continua*, Proc. Amer. Math. Soc., 9 (1958), 530–532.

[29] *R. L. Moore's Axiom 1' and Metrization*, Proc. Amer. Math. Soc., 9 (1958), 487.

[30] *Moore spaces and uniform spaces*, Proc. Amer. Math. Soc., 9 (1958), 483–486.

[31] *Product spaces in n-manifolds*, Proc. Amer. Math. Soc., 10 (1959), 33–34, with G. S. Young.

[32] *On the first countability axiom for locally compact Hausdorff spaces*, Colloq. Math., 7 (1959), 33–34.

[33] *Another homogeneous plane continuum*, Trans. Amer. Math. Soc., 90 (1959), 171–192, with R. H. Bing.

[34] *Another cutpoint theorem for plane continua*, Proc. Amer. Math. Soc., 11 (1960), 556–558.

[35] *Cyclic connectivity of plane continua*, Pac. J. Math., 11 (1961), 1013–1016.

[36] *On the existence of a small connected open set with a connected boundary*, Bull. Amer. Math. Soc., 68 (1962), 117–119.

[37] *A fixed point free mapping of a connected plane set*, Colloq. Math., 11 (1963), 73–74.
[38] *Stone's 2-sphere conjecture*, Amer. J. Math., 87 (1965), 497–501.
[39] *Metrization*, Amer. Math. Monthly, 73 (1966), 1–16.
[40] *Remarks on the normal Moore space metrization problem*, Madison Summer Inst., 1965. Princeton University Press, 1966.
[41] *Connected G_δ graphs*, Duke Math. J., 33 (1966), 341–345, with E. S. Thomas.
[42] *Stronger forms of aposyndetic continua*, Proc. Topology Conference, Arizona State Univ. (1967), E. E. Grace, Editor, 170–173, with E. J. Vought.
[43] *On the plane one-to-one map of a line*, Colloq. Math., 19 (1968), 231–233.
[44] *On fake Souslin trees*, Duke Math. J., 36 (1969), 571–574.
[45] *Topology in the Secondary Schools?* Australian Math. Teacher, 24 (1968), 86–91.
[46] *Homogeneous plane continua*, Proc. Auburn Topology Conference, March 1969.
[47] *One-to-one continuous images of a line*, Fundamenta Math., LXVII (1970), 285–292.
[48] *Gordon T. Whyburn, 1904–1969*, Bull. Amer. Math. Soc., 77 (1971), 57–72, with E. E. Floyd.
[49] *One-to-one continuous images of a line*, General Topology and its Relations to Modern Analysis and Algebra, Proc. of the Kanpur Topological Conference, 1968, 157–160.
[50] *Countable, locally connected, connected spaces*, Proc. of the Topology Conference, Emory University, 1970, 52–62.
[51] *The utility of empty inverse limits*, General Topology and its Relations to Modern Analysis and Algebra III, Proc. of the Third Prague Topological Symposium, 1971.
[52] *Countable locally connected Urysohn spaces*, Colloq. Math., 22 (1971), 239–244, with A. H. Stone.

[53] *Tall trees and inverse limits*, Proc. Univ. Houston, Point-set Topology Conference, 1971, pp.143–155.
[54] *Aposyndesis revisited*, Proceedings of the Oklahoma Topology Conference, 1972, pp. 64–78.
[55] *Aposyndetic continua*, Colloquia Mathematica Societatis Janos Bolyai, 8. Topics in Topology, 437–447, Keszthely (Hungary), 1972.
[56] *Homogeneous continua*, Topology and its Applications, 129–131, Boegrad, 1973.
[57] *Constructing non-completely regular spaces*, Topology and its Applications, 132–135, Boegrad, 1973.
[58] *Hereditarily separable, non-completely regular spaces*, Topology Conference (VPI), Lecture Notes in Mathematics, 375 (1973), 149–151.
[59] *Connected simple graphs and a selection problem*, Czechoslovak Math. J., 25(100), 1975, 300–301.
[60] *Use of a new technique in homogeneous continua*, Houston J. Math., 1 (1975), 57–61.
[61] *The Moore method*, American Mathematical Monthly, 84 (1977), 273–278.
[62] *Wilder on connectedness*, Proc. Wilder Topology Symposium, UCSB, July, 1977, Lecture Notes in Math. 664, 1–6.
[63] *On a generalization of the n-arc theorem*, Proceedings of the Warsaw Topology Conference, 1978.
[64] *Metrization, non-metrization and a bit of history*, Topology Conference 1979, pp. 1–4, October 13–14, 1979, at the University of North Carolina at Greensboro.
[65] *Aposyndesis, homogeneity and a bit more of history*, ibid. pp. 79–84.
[66] *Aposyndesis*, General Topology and Modern Analysis, pp. 19–9, Edited by L. F. McAuley and M. M. Rao, Academic Press, 1981.
[67] *The beginning of topology in the United States and the Moore school*, Handbook of the History of General Topology, 1 (1997), 97–103.

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