Review: [Untitled]

Reviewed Work(s):

*Mathematical People: Profiles and Interviews.* by Donald J. Albers; G. L. Alexanderson
Ann Hibner Koblitz


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$d$-polytope with $n$ $(d-1)$-dimensional faces. This was accomplished by the Lower Bound Theorem and the Upper Bound Theorem of Barnette and McMullen, respectively.

One of the main ingredients in McMullen's proof (see P. McMullen and G. C. Shephard, *Convex Polytopes and the Upper Bound Conjecture*, Cambridge University Press, 1971) was his use of a particular reformulation of the Dehn-Sommerville equations, which led him to a set of conditions that he conjectured would solve the characterization problem for $f$-vectors.

Then Stanley revealed the algebraic significance of this reformulation. He demonstrated that for a certain class of simplicial complexes, including boundary complexes of simplicial polytopes, there are naturally associated Cohen-Macaulay graded algebras. As a consequence of this, the Dehn-Sommerville equations turn out to be a manifestation of Poincaré duality. Stanley used this information to obtain a new proof of the Upper Bound Theorem and extended it to the strictly larger class of simplicial spheres as well. In the process, he determined new necessary conditions on the $f$-vectors of simplicial polytopes.

Ultimately, in 1979, Stanley made a further algebraic connection between simplicial polytopes and the cohomology of complex projective varieties that implied the necessity of McMullen's proposed conditions for $f$-vectors. At about the same time Billera and the reviewer succeeded in showing that McMullen's conditions were also sufficient to guarantee the realizability of an $f$-vector, completely solving the characterization problem. Whether the conditions also hold for simplicial spheres is an open question. Whether, as in the case of Euler's relation, an entirely elementary geometric proof of McMullen's conditions can be found, free of the elegant but elaborate techniques of algebraic geometry, also remains to be seen.

Björner's book provides an introduction to the theory of convex polytopes, developing enough of the subject to be able to present proofs of Euler's relation, the Dehn-Sommerville equations, and the Lower and Upper Bound Theorems. Bröndsted chooses to demonstrate the latter three within the context of simple polytopes. Though not proving McMullen's characterization, he does show how the Lower and Upper Bound Theorems are corollaries of this more general result.

In the meantime, more information is being accumulated about the combinatorial structure of convex polytopes that may eventually lead to further breakthroughs in the central classification problems.

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I'm a math groupie.* I confess it unabashedly. After all, there are many less pleasant groups of people with which one could fall into company than mathematicians. Speaking in generalities, I find that mathematicians, both historically and in the present, have many admirable qualities. They are tolerant of diversity (political as well as social and cultural), they are curious about the world, they have a quirky sense of humor and a keen feeling for the ridiculous, they tend to be elementally weird in ways I find endearing, even admirable.

For me, it comes as no surprise that the first woman in modern times appointed to a university

*For those of you not familiar with the term, or familiar only with the unfortunate sexual connotations of the word as used in the phrase "rock groupie," by groupie I mean a fan, an admirer, a partisan of mathematicians. In other words, when faced with groups of mathematicians, historians, social scientists, businessmen, etc., I prefer to hang around with the mathematicians.
chair in any field was a mathematician (Sofia Kovalevskaià), nor that when a survey of German
professors was taken in 1896, mathematicians topped the list of those favoring the admission of
women to universities (while historians were least favorable to women's higher education).

Historically, mathematicians have tended to take the attitude that anyone capable of proving
good theorems should be welcomed into the mathematical community. This does not mean that
they necessarily give any active encouragement to women, minorities, the economically disad-
vantaged, or the socially inept. Rather, this means that once talented members of the groups
above have made their way through, around, and over the numerous obstacles society places in
their way, mathematicians will more or less readily acknowledge their achievements and make a
place for them in the mathematical world. (No, this does not automatically happen in other
disciplines, contrary to what some engagingly naive mathematicians and many old-style Jackso-
nian democrats might think!)

As a consequence of this relatively tolerant attitude, one tends to find all sorts of people,
including what an unsympathetic observer might characterize as an odd assortment of nuts and
flakes, occupying respectable positions within the mathematical community. It is in part this
aspect of the mathematical world that I find so fascinating, and I welcome any chance to increase
my knowledge of the various types of people who work in mathematics and mathematics-related
fields.

Mathematical People provides an excellent opportunity to acquaint oneself with the life stories
and opinions of a large number of men and women whose livelihoods and avocations have
something to do with mathematics. The majority of the selections in the book are interviews with
famous and near-famous mathematical people, some of which first appeared in the College
Mathematics Journal. The rest are profiles and autobiographical or biographical sketches; with the
exception of the pieces on Raymond Smullyan and John Horton Conway, in my opinion these are
the least successful segments in the collection. The book is sprinkled with portraits, drawings,
photographs, all of which contribute to the pleasantly homely, casual tone sustained throughout
most portions of Mathematical People.

On the whole, I found the collection fascinating. Most of the mathematical people interviewed
expressed themselves well, and had intriguing, if sometimes idiosyncratic, opinions about virtually
everything. To my mind, the most felicitous combinations of astute questions and informed,
engaging responses were in the interviews with David Blackwell, Persi Diaconis, Martin Gardner,
John Kemeny, Donald Knuth, Henry Pollack, Constance Reid and Herbert Robbins. Reading
Blackwell and Diaconis on how they meandered their way into mathematical careers—or on any
other topic either of them cared to tackle—is a delight. (Blackwell started out intending to
become an elementary school teacher, while Diaconis left home at the age of fourteen for ten
years on the road as a professional magician.)

A few of the selections are singularly infelicitous, either because the interview didn't gel, or
because the text was insufficiently edited, or because the subject was essentially boring. (Yes, even
among mathematicians one occasionally comes across a real yawner. But I only found one in
Mathematical People, and he shall remain nameless.) And one or two comments by the elder
statesmen of mathematics will make some readers squirm with vicarious embarrassment. In this
connection, one might mention the charmingly childlike naïveté of Paul Halmos's statement on
page 127: "I don't think mathematics needs to be supported. I think the phrase is almost
offensive. Mathematics gets along fine, thank you, without money, and I look back with nostalgia
to the good old days, three or four hundred years ago, when only those did mathematics who were
willing to do it on their own time." Ah yes, bring back the good old days when only men of the
gentry did mathematics!

I am not going to even try to be objective about Mathematical People. Everyone will have his
or her own reaction to the book. Some people will no doubt throw it aside in disgust (an unwise
move, however—Mathematical People is, if nothing else, a hefty projectile), while others will be
indignant that I find any deficiencies in the collection at all. Some will be disappointed that their
favorite mathematical personalities were somehow missed (my missing favorites are Mark Kac, Serge Lang, and André Weil). But as the editors point out, that can't be helped. No collection of this type can hit everyone.

*Mathematical People* is not the type of book to be read cover to cover, or to be looked at when one is in a serious mood. Nor is it a book that will particularly appeal to historians of mathematics (at least not for the next fifty years or so) except as bedtime reading. And don't give it to Aunt Jane and Uncle Theodore as your last-ditch attempt to convince them that you and your colleagues are just like everyone else—it won't work.

On the other hand, if you're looking for something to read in front of the fire on a long winter evening, or want to show Aunt Jane and Uncle Theodore the quirky-but-charming side of your profession, or tend to give your immediate family books you know you will enjoy reading, then give *Mathematical People* a try. The collection is well constructed, and has something to interest and entertain anyone with any connection to the mathematical world.

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What is functional analysis? It is not easy to give a comprehensive defining statement. The boundaries of the field may be set in quite different ways, depending on how much noncommutative harmonic analysis or partial differential equations one embraces. At the core of functional analysis are normed spaces and more generally topological vector spaces, together with the functionals and operators thereon. The spaces usually come equipped with a potpourri of topologies. The hallmark of functional analysis is DUALITY, oftentimes in the form of the Hahn-Banach theorem in one of its manifold guises. The methods of duality fall under the rubric of "soft" analysis. When uttered by certain "hard" analysts, the word "soft" can assume a pejorative tone, yet even the most militant of the hard analysts do not blush upon invoking the Hahn-Banach theorem.

Functional analysis has served as a useful and unifying tool in numerous areas of mathematics, particularly differential equations and more recently stochastic theory. It has also become a fascinating and fruitful object of study for its own sake. The scope of the subject can be appreciated by reviewing its history, still fresh and quite interesting in its own right. The most complete and authoritative overview has been provided by Dieudonné in his *History of Functional Analysis*, reviewed by R. S. Doran for the *Bull. Amer. Math. Soc.*, 7(1982), pp. 403–409.

The field of functional analysis was virtually nonexistent before 1900. The seeds for the birth of functional analysis were sown towards the end of the nineteenth century, when certain problems stemming from the partial differential equations of mathematical physics were recast as integral equations of Fredholm type. The first decade of the twentieth century saw the birth and explosive growth of functional analysis, commencing with the seminal studies of Fredholm (1900–1903) of the class of integral equations which bears his name. Inspired by Fredholm, Hilbert (1906) investigated bilinear forms on infinite dimensional sequence spaces and established essentially the spectral theorem for compact symmetric operators. Meanwhile Lebesgue (1902) introduced his theory of integration, which was to provide the context for much of functional analysis. E. Fischer (1907) and Frigyes Riesz (1906) showed independently that the $L^2$-spaces associated with the Lebesgue integral are complete. By the end of the decade Riesz had introduced the $L^p$-spaces and obtained in essence the representation theorem for their duals. In the meantime, Fréchet had introduced in his thesis (1906) the fundamentals of metric spaces, paying special attention to the
Review: [Untitled]

Reviewed Work(s):

*More Mathematical People: Contemporary Conversations* by Donald J. Albers; Gerald L. Alexanderson; Constance Reid
Douglas Quadling


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Reviews


Why “more” mathematical people?

The “more” qualifies “people”, not “mathematical”. The book is a sequel to Mathematical people by two of these authors, published in 1958 and reviewed by Nick Lord in Gazette number 451 (March 1986).

Who are they?

Of the 18 subjects, all but one have pursued mathematical careers in the USA, the exception being Robin Wilson of the Open University. However, four were born in continental Europe, and three others had emigré parents. Some are prominent research mathematicians, others are best known as expositors or administrators. Three are women (and a half – Aanneli Lax appears as a mathematical wife). Their years of birth range from 1904 to 1946, the modal decade being the 1910s.

What does the book tell us about them?

A lot about their family background and early training. I found interesting (and often humbling) how many had become successful mathematicians without conventional education in the subject, either at school or as undergraduates, and sometimes despite severe deprivation and insecurity. The subjects were also invited to talk about their career preferences and methods of working, and some of them took the opportunity to share their philosophical perceptions of mathematics.

Does it have any mathematical content?

Not explicitly, but there are some important insights into the development of modern mathematics, such as linear programming (George Dantzig), the structure of topological groups (Andrew Gleason), asymptotic methods in statistics (Lucien Le Cam) and the decidability of diophantine equations (Julia Robinson).

Do you have any reservations about this book?

Yes – the “question and answer” format, as parodied in this review. It has the advantage that you have the sense of reading the actual words of the interviewees, but it gets very tedious after 300 pages, and invites banality and triviality. [“But Euler was a pretty smart guy.” “Yes, but I never really felt I was going to ace him out of anything.” (Bill Gosper). “You really feel that?” “Yeah. Definitely.” (Steve Smale).] It was a relief to get back to the more condensed style of Lucien Le Cam’s autobiographical sketch, and the posthumous memoir of Julia Robinson by her sister Constance Reid.

Would you buy it for the library?

Yes. Nick Lord described the earlier volume as a “mathematical coffee-table book”, and it is an attractively lavish production – and for what it is, not unreasonably expensive. If it convinces students that mathematics is done by a great diversity of real people with families, hobbies and passions, it will fully justify its place. But what about a similar volume on British (or European) mathematicians?

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It is not always easy to answer students who ask about how mathematics is used in the real world! This collection of articles has been gathered together by the Institute