
Foreword

This volume is dedicated to John Benedetto. It seems just yesterday that we celebrated his 60th birthday in a memorable conference in College Park. Yet that was October of 1999, and already more than six years have passed. But John is still too young to be fully honored by a single foreword, or even a single volume, that attempts to summarize the impact of his work on harmonic analysis, his students, and his coworkers. Given his continuing high (and even increasing) level of activities, his list of “lifetime achievements” is surely far from complete. Even so, we will make an attempt in this foreword to take a look back, to see the major lines of his work and activities during the past 40 years of his life as a scientist, and to learn from his biography (and bibliography) how the field of harmonic analysis has changed over the years, and in particular to see the vibrant role that John has taken in this process.

John’s first paper appeared in 1965, when he was 25 years old, and his first book (the Springer Lecture Notes on *Harmonic Analysis on Totally Disconnected Sets*) when he was 31. By that time he had already published on the subjects of Tauberian algebras, in the theory of generalized functions, and on questions related to spectral synthesis. His work on this latter topic continued through the 1970s, culminating in the insightful volume *Spectral Synthesis* (1975). Only a year later, his text *Real Variables and Integration with Historical Notes* appeared.

In recent years John has published a variety of mathematical papers that include practical applications, yet this is not really a “new” direction for him. Already in 1981 one finds a paper titled “The theory of constructive signal analysis” (Stud. Appl. Math., Vol. 65, pp. 37-80). It is clear from this and his entire bibliography that John has studied the work of Norbert Wiener in great detail, and indeed on many occasions John has confessed that Wiener is his “hero.” For example, he connected his earlier work on Tauberian theorems with the uncertainty principle, and in 1989 published (jointly with his former Ph.D. students George Benke and Ward Evans) an n -dimensional version of the Wiener–Plancherel formula, whose 1-dimensional formulation Wiener chose to have on the cover of his autobiography, *I Am a Mathematician*.

In 1990 his first article relating irregular sampling and frame theory appeared, published jointly with another one of his (numerous) students, William Heller. A series of papers on Fourier transform inequalities with weights were written together with his friends, Hans Heinig and Raymond Johnson, between 1982 and 2003.

In the 1990s one finds a substantial number of papers related to wavelet and time-frequency analysis. When the “wavelet-wave” took off around 1990,¹ John was one of the first to realize the relevance of what we nowadays call application-oriented harmonic analysis (more on this later). He encouraged two of his students (Chris Heil and Dave Walnut) to compile, from the material they had collected during their research for their Ph.D. theses, a survey article on wavelets, frames, and time-frequency analysis. This article, published in *SIAM Review* in 1989, was an important source for researchers seeking to enter wavelet theory during its early development. John’s book *Wavelets: Mathematics and Applications*, jointly edited with Michael Frazier in 1994, was one of the very first books to contain a nearly complete overview of the most important aspects of wavelet theory, from theory to applications, from the construction of orthonormal wavelet systems to their use in a variety of disciplines, from image compression to turbulence. We do not have space to mention every paper and book of John’s, but let us mention his text *Harmonic Analysis and Applications*, which appeared at about the same time (1996). This book provides a detailed account of Fourier analysis, including, for example, the basics of distribution theory and its use in Fourier analysis, classical topics such as summability kernels, and modern topics such as the construction of orthonormal wavelets found by Ingrid Daubechies. John’s understanding of the historical development of the field and the impact of history on the directions the field has taken is clearly evident in this volume.

John is not only a dedicated researcher and gifted writer, but is also an engaging lecturer, teacher, and advisor. By any standard in mathematics, both the number of Ph.D. students he has directed and the number he is currently supervising are very high. Yet he devotes to each of them a regular time-slot for the discussion of their work and progress. This provides them invaluable help developing good scientific taste and instincts and the chance to get on their own feet as mathematicians, all on a very individual basis. It is no surprise that a large proportion of his Ph.D. students are engaged in active research positions, both in academia and in industry, within the USA and around the world.

In addition to his research, teaching, and all the standard duties of a mathematician—reviewing papers for journals or proposals for funding agencies, organizing meetings, serving within his department—John has been deeply involved in a number of projects that are establishing harmonic analy-

¹I happened to spend the academic year 1989/90 in College Park and can therefore report from first-hand experience.

sis not only as an important part of classical mathematics, but also as a vital and highly visible branch of mathematical analysis.

Obviously John's view of harmonic analysis and the role it plays in the modern scientific endeavor are extremely broad. As was the case for his hero, Wiener, there seems for him to be no distinction between "pure" and "applied" mathematics, his work ranges seamlessly across what others perceive as boundaries. Perhaps his many hours spent as an employee of or consultant to such engineering companies as RCA, IBM, and The MITRE Corporation have shown him both how harmonic analysis can be applied and the needs and perceptions of those seeking to solve real-world applications.

Amongst his various activities that have increased the visibility of harmonic analysis I want to first mention that John developed and implemented (together with Wayne Yuhasz at that time at CRC Press) the idea for JFAA, the *Journal of Fourier Analysis and Applications*. The first issue appeared in 1993. I had the great honor to take over from John the chief editorship of this journal in 2000. By this time the journal was well established and had moved to Birkhäuser. It was John's wise decision not to devote the journal only to a single specialized topic, such as wavelets, but rather the entire discipline of Fourier analysis (understood in the widest sense), and at the same time to emphasize the importance of applications, of which we hope to see even more in the years to come.

In a similar direction, John's establishment and editorship of the Birkhäuser book series ANHA, *Applied and Numerical Harmonic Analysis*, again is lending significant visibility to the community. The series contains many of what are now the standard texts in the field. ANHA has become a "first place" for readers and authors to look at, in order to check what is going on in the field, or to find a good series in which to publish.

Most recently John has begun another highly visible initiative by establishing the *Norbert Wiener Center for Harmonic Analysis and Applications* at his home university, the University of Maryland, College Park. The description of the aims and goals of this center shows his views and ambitions, namely, to "provide a national focus for the broad emerging area of Mathematical Engineering." The need for this is clear: while there is more and more need for the development of mathematical tools and algorithms for real-world applications, the mathematical community generally does not provide sufficient "practical" training for its students to address such problems (typically viewed as being "too applied"), while the engineering community likewise does not generally provide sufficient pure mathematical training for its students to address these problems (typically viewed as "too abstract"). But in fact, these two disciplines *are* very close together, and the Norbert Wiener Center seeks to bring them into direct contact, to support each other, and most importantly to bring the questions on each side to the attention of the other side. John has shown in his own work the benefits of such interaction. Let us hope that his spirit, supporting serious mathematical research, ranging through the spectrum of harmonic analysis from "pure mathematics" to "practical applications" will

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continue on strongly, bringing back new mathematics and new applications.
Let us wish John much success in this endeavor and in the years to come.

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Hans G. Feichtinger