

## Robert F. Port

*Professor of Linguistics; Adjunct Professor of Computer Science*

Robert Port was born in Chicago and spent his elementary school years in rural Wisconsin living on a farm. His high school years were in Cleveland suburbs and then he went to Johns Hopkins University. A year before graduation Port went to Kenya with the Peace Corps where he learned Swahili, which he still speaks. Port and his wife, Professor Diane Kewley-Port, married in Nairobi in 1967. Soon it was graduate school in linguistics at Columbia, but while there he became attracted to the laboratory phonetics of Haskins; so after an M.A., he moved to the University of Connecticut to join the Haskins Laboratories faculty in Storrs and New Haven. He completed his dissertation at Connecticut just before his first semester as a faculty member in linguistics at Indiana University in fall 1976.

Port's research has focused on the question of how language is represented in memory. For the first decade, he conducted primarily experimental studies of the details of speech timing characteristics of different languages, demonstrating the importance of language-specific timing patterns in phonetics. Another important result was the discovery that some patterns of "neutralization" create a problem for the traditional view of phonetic transcription. "Neutralization" occurs when a contrast is lost in a certain context, as for example the distinction between /t/ and /d/ in *butt* vs. *bud*, which disappears when those consonants appear between vowels, as in *butting* vs. *budding*. They seem to sound identical but actually do not completely neutralize in most cases. This is a surprising result for traditional phonetics and phonology because phonetic segments (like symbols in an alphabet) should either be distinct or else be the same.

These results—showing that very tiny temporal details are produced and perceived—confirm that timing detail is an essential component of the memory specification of words, and that languages differ from each other in their timing patterns and preferred rhythmic structures. This work also confirmed to Port that linguistics and phonetics could not be studied in isolation from other areas of cognitive science.

Beginning in the early 1980s, Port turned to the mathematics of dynamical systems to seek conceptual and analytical tools suitable for the description of speech timing. One of the new tools available then was the "neural network," which he sought to use to describe the temporal properties of speech. He co-taught IU's first regular course on neural network models of cognition in 1986 (with Professor Stan Kwasny of computer science) with about 20 graduate students from computer science, psychology, philosophy, and linguistics. But the neural networks of the time, it became clear to him, might simulate perception of speech but, by themselves, would not be sufficient to describe sound patterns in language. So he searched more broadly in dynamical models of cognition, joining a group of faculty—including Tim van Gelder (philosophy); Esther Thelen, Linda Smith, Peggy Peterson, Geoffrey Bingham (psychology); Michael Gasser (computer science); and Bev Ulrich (health, physical education, and recreation)—who called themselves the "Dynamos." They read papers and obtained an internal grant to invite speakers. A further result of focusing on dynamics was that Port co-organized with Professor van Gelder a

national conference in 1992 at IU. Together they published a volume of commissioned papers: *Mind as Motion: Explorations in the Dynamics of Cognition* (MIT Press, 1995). The book sought to introduce dynamical thinking to scientists in many areas of cognitive science and to link together research traditions that were scarcely aware of each other. In their introductory chapter, van Gelder and Port made a general case that the application of dynamical modeling was an essential step toward understanding human cognition.

Port was one of the founding faculty members working with Professor Richard Shiffrin to create the IU Cognitive Science Program, which opened in 1989. A major contribution of his was Q500, the graduate-level Introduction to Cognitive Science. The course was intended to provide a common intellectual basis for the program's double-major graduate students across the disciplines that comprise cognitive science. Port taught the course regularly from 1989 until 1999, when it was restructured for the new independent cognitive science doctoral program.

As a phonetician, Port sought evidence to show that speech is a dynamical behavior with many features in common with other dynamical motor behaviors such as reaching and walking. It seemed that the case could be made if one could show that speech can be easily entrained to a periodic pattern of some kind. One basic method for understanding observed dynamical systems is to perturb their oscillation to see how the system recovers. Clearly limbs "like" to oscillate periodically and detailed dynamical models of limb motions had proven quite successful. It turned out to be easier than he expected to show that speech also "likes" to be periodic. If a person simply repeats a short phrase over and over, he will notice that the repetitions quickly organize themselves into a nested pattern of 2- or 3-beat periodic cycles that are described beautifully with standard musical notation using measure bars and quarter notes. Port's claim was not that speech timing is achieved with quarter notes, but that quarter notes and measure-like timing cycles can easily become attractors for the complex dynamics of speech production. Actual productions may vary greatly, but the fact that there are attractors in time tells us a great deal about how the speech production system works and what the perceptual system needs to model with its own dynamics in order to perceive these partially rhythmic patterns.

Port received several research grants from NIH, NSF, and the Office of Naval Research. He edited two books and published about 80 research papers. He directed 20 Ph.D. dissertations and served on the committees of more than 50 others from 10 different departments or programs.

Port's family has many links with IU. In addition to his wife, who is in the Department of Speech and Hearing Science, his son, Professor Nicholas Port, is in the Program in Neuroscience. And one of his two daughters has a B.A. from IU.

*Stuart Davis*