Podcast Name: *ACM ByteCast*
Episode: Roger B. Dannenberg

Welcome to the *ACM ByteCast* podcast, a series from the Association for Computing Machinery! The podcast features conversations with researchers, practitioners, and innovators at the intersection of computing research and practice about their experiences, lessons learned, and visions for the future of computing. In this episode, host Bruke Kifle is joined by Roger B. Dannenberg, a pioneer in the field of computer music. A professor emeritus at Carnegie Mellon University, Dr. Dannenberg has a distinguished career spanning over four decades, with contributions to programming languages, AI music systems, and real-time interactive systems. Notably, he co-created Audacity, a popular audio editor, and is an accomplished musician and composer.

To begin, Dr. Dannenberg describes his lifelong passion for both science and music. Growing up, he learned technical skills from his father's workshop and pursued trumpet playing and music composition. A pivotal moment occurred in high school when he discovered an analog synthesizer, which ignited his fascination with the connection between sound, mathematics, and physics. Initially, Dr. Dannenberg pursued computer science as a practical career while continuing to develop his music skills. After completing his PhD at Carnegie Mellon, he began integrating music with computing. He describes the process of merging his personal passion with academic pursuits, leading to innovative projects like computer accompaniment systems. He developed systems where computers could listen to live musicians and synchronize with them in real time.

Dr. Dannenberg reflects on the evolution of interactive computer music since the 1980s, noting the exponential growth in computing power. Early in his career, creating sound required specialized hardware, whereas today, software-based audio processing is ubiquitous, enabling highly sophisticated and interactive music systems. He emphasizes the potential of AI in music, particularly in enhancing creativity and live performance. Then, Dr. Dannenberg discusses the challenges and opportunities AI presents for music and creativity. He highlights how musicians have historically adopted new technologies, from mechanical innovations in instruments to electronic and digital advancements. While AI could potentially disrupt traditional roles in music composition and performance, it also opens new artistic possibilities. There is a need to balance efficiency with preserving the human labor and creativity that define music.

As the co-creator of Audacity, Dr. Dannenberg highlights several key principles and innovations that have guided the development of the software. Initially created as a tool to visualize audio waveforms and spectra for research, Audacity evolved into a powerful open-source audio editor. The commercial software at the time was narrowly task-specific, treating audio files as monolithic entities. This approach made editing slow due to the limitations of hardware and disk speeds. Its performance and accessibility have made it a staple tool for millions of users, ranging from amateur music enthusiasts to professional producers.

Another innovation tied to Audacity is the inclusion of the Nyquist programming language, an audio composition and synthesis tool. Nyquist allows users to write high-level audio effects directly within Audacity.

Open-source software like Audacity has played a significant role in democratizing music production. With over a million downloads per month for over a decade, Audacity has provided high-quality audio editing tools to users worldwide, even on low-end hardware. Many young people credit Audacity as their introduction to music production, paralleling the experience of discovering analog synthesizers in earlier decades.

Before wrapping up, Dr. Dannenberg highlights recent projects, including a collaboration on an opera translation and research into the structure of music. A current focus is on understanding music through prediction and entropy, which are central to repetition and anticipation in music composition. The team employs hidden Markov models and sequence learning techniques to identify patterns and repetition in music, exploring how these elements influence structure, harmony, and pitch. The goal is to uncover universal principles that underlie all forms of music—from popular to classical to bebop. Unlike current AI models, which tend to focus on formulaic popular music, this research aims to analyze broader musical traditions and understand their shared characteristics.

Finally, Dr. Dannenberg reflects on his role as an academic and advisor, and the importance of interdisciplinary expertise, particularly a strong foundation in music knowledge and passion. Many technically skilled students struggle to succeed in music-related fields because they lack a deep understanding of music itself. Truly interdisciplinary success requires a blend of technical and musical expertise. This balance ensures meaningful contributions to fields that bridge music and technology.

Timestamps:
2:33 - Dr. Dannenberg's early interests and career journey.
3:54 - Combining music and computer science.
10:39 - Advancements in interactive computer music.
15:29 - Balancing AI and human creativity in music.
19:50 - The evolution of Audacity.
28:58 - Open Source and its impact on accessibility.
36: 00 - Advances in music analysis and composition.

Links
Learn more about [Roger B. Dannenberg](#).
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