Harriet Padberg: Computer-Composed Canon and Free-Fugue Renascence

Harriet Padberg, born November 13, 1922, spent her life as a member of the ministry of a Roman Catholic women's congregation titled the Society of the Sacred Heart. She received a PhD in Mathematics and Music from Saint Louis University in 1964 before beginning her tenure as a professor of those disciplines at Maryville University in St. Louis, Missouri. During her tenure, she further advanced the use of computer music through her establishment of the university's Music Therapy program in 1978. The Music Therapy program proved to be an initial spark of interest in audition and therapy for Maryville, leading to the creation of its Occupational Therapy and Speech-Language Pathology programs some years later. Padberg later worked as a music therapist herself, and opened a music ministry in 1992.

Padberg's doctoral thesis, "Computer-Composed Canon and Free-Fugue", may be the first dissertation on algorithmic composition using computers. In this work, Padberg combined traditional music theory with a novel text-to-music algorithm contrasting largely used stochastic methods. Padberg's dissertation is especially impactful; it is both likely the first to be written about algorithmic composition, and it pioneered the use of text input instead of the random number generation used in her contemporaries' pieces (e.g. the *Illiac Suite*).

While the original code is made available in the dissertation, the ability to run it, experiment with it, or sonify its outputs is inaccessible; it was written for the IBM 1620 and 7072, machines which can most likely only be found in museums. The authors have thus recreated the software in Python and are releasing it as an open-source, stand-alone program. The purpose of this renascence is to allow anyone to use and interact with Padberg's system, providing a window into music technology history and the ability to reimagine the system's potential uses for new work.

Despite its originality and relevance to the work of more prominent algorithmic composition figures such as Ljaren Hiller and Max Matthews, Padberg's, "Computer-Composed Canon and Free-Fugue," remains obscure and rarely referenced. With the exception of Hiller's survey, her dissertation is not mentioned in any of Hiller's or Mathews' papers about computer music despite both of them communicating with her and learning from her approach. Despite her work at Maryville and with her own ministry, it remains her only publication. Nevertheless, this piece remains a vital example of algorithmic composition research and a significant part of the history of early computer music.

"Computer-Composed Canon and Free-Fugue" describes an algorithm which can be seen today as having started modern text-to-music approaches - processing text into features used to define sounds, rhythms and structures which form the basis for composition. Drawing her aesthetic design choices from her roots in traditional fugue style and 20th century serialism, as well as her background in mathematics, she created a unique program that deviated from the randomness used by other commercial and academic computer musicians at the time and

realized, “new and powerful opportunities available with computer implementation," for classical music.

Selected Bibliography

[1] H. A. Padberg, ”Computer-Composed Canon and Free Fugue, Ph.D.Dissertation, St. Louis University, St. Louis, MO, United States, 1964.
[2] H. A. Padberg, Program 2. [FORTRAN], St. Louis University, St. Louis,MO, United States, 1964.
[3] T. Magnusson, A. McLean, N. Collins, ”DVD Program Notes,” Computer Music Journal, vol. 35, no. 4, pp. 119-137, January 2011.
[4] C. Ariza, ”Two Pioneering Projects from the Early History of Computer-Aided Algorithmic Composition,” Computer Music Journal, vol. 35.3,pp. 40-56, January 2012.
[5] L. Hiller, Music Composed with Computers: A Historical Survey, H.B. Lincoln, ed. The Computer and Music. Ithaca, New York: Cornell University Press, pp. 4296, 1970.
[6] C.J. Bashe, L.R. Johnson, J.H. Palmer, E.W. Pugh, IBM’s Early Computers. Cambridge, MA: MIT press, 1986.
[7] J.D. Fernandez and F. Vico, ”AI Methods in Algorithmic Composition:A Comprehensive Survey”, Journal of Artificial Intelligence Research,vol. 48, pp. 513-582, 2013.
[8] Rscj.org. (2018). Harriet Padberg, RSCJ — RSCJ.org. [Online]. Available: https://rscj.org/about/memoriam/harriet-padberg-rscj [Accessed 23Oct. 2018].
[9] Music Therapy, College of Health Professions. [Online]. Available: https://www.maryville.edu/hp/music-therapy/. [Accessed: 06-Nov-2018]
[10] Savery, Richard, et al. "Learning from History: Recreating and Repurposing Sister Harriet Padberg's Computer Composed Canon and Free Fugue." arXiv preprint arXiv:1907.04470 (2019).

Screenshot - Processed Text