

Digital Da Vinci: Computers in Music

Newton Lee

Springer Science+Business Media

February 2014

About the Book

This book opens with the interviews of music mogul Quincy Jones, MP3 inventor Karlheinz Brandenburg, Tommy Boy founder Tom Silverman, and entertainment attorney Jay L. Cooper. A strong supporter of science, technology, engineering, and mathematics programs in schools, The Black Eyed Peas founding member will.i.am announced in July 2013 his plan to study computer science.

Leonardo da Vinci, the epitome of a Renaissance man, was an Italian polymath at the turn of the 16th century. Since the Industrial Revolution in the 18th century, the division of labor has brought forth specialization in the workforce and university curriculums. The endangered species of polymaths is facing extinction. Computer science has come to the rescue by enabling practitioners to accomplish more than ever in the field of music.

In this book, Newton Lee recounts his journey in executive producing a Billboard-charting song like managing agile software development; M. Nyssim Lefford expounds on producing and its effect on vocal recordings; Dennis Reidsma, Mustafa Radha, and Anton Nijholt survey the field of mediated musical interaction and musical expression; Isaac Schankler, Elaine Chew, and Alexandre François describe improvising with digital auto-scaffolding; Shlomo Dubnov and Greg Surges explain the use of musical algorithms in machine listening and composition; Juan Pablo Bello discusses machine listening of music; Stephen and Tim Barrass make smart things growl, purr, and sing; and last but not least, Kai Ton Chau concludes the book with computer and music pedagogy.

Digital Da Vinci: Computers in Music is dedicated to polymathic education and interdisciplinary studies in the digital age empowered by computer science. Educators and researchers ought to encourage the new generation of scholars to become as well rounded as a Renaissance man or woman.

Contributors

Stephen Barrass is a researcher and academic at the University of Canberra where he lectures in Digital Design and Media Arts in the Faculty of Arts and Design. He holds a B.E. in Electrical Engineering from the University of New South Wales (1986) and a Ph.D. titled Auditory Information Design from the Australian National University (1997). He was a Post-Doctoral Fellow at the Fraunhofer Institute for Media Kommunikation in Bonn (1998) and Guest Researcher in Sound Design and Perception at IRCAM in Paris (2009).

Tim Barrass has a background in electronic arts practice spanning over 20 years. In his visual and sound work he has explored ways of generating and understanding patterns of interaction in complex systems. He spent many years as a circus musician, developing custom software for electroacoustic instrumental performance in unpredictable circumstances. In recent times his focus has been on developing Mozzi, the sound synthesis library for Arduino. He is currently researching the ergonomics of typing with a cockatiel on each forearm.

Juan Pablo Bello is Associate Professor of Music Technology at New York University, with courtesy appointments at the Department of Electrical and Computer Engineering, and NYU's Center for Data Science. In 1998 he received a BEng in Electronics from the Universidad Simón Bolívar in Caracas, Venezuela, and in 2003 he earned a doctorate in Electronic Engineering at Queen Mary, University of London. Juan's expertise is in digital signal processing, computer audition and music information retrieval, topics in which he actively teaches, researches and publishes. His work has been supported by public and private institutions in Venezuela, the UK, and the US, including a CAREER award from the National Science Foundation. He co-founded the Music and Audio Research Lab (MARL), where he leads research on music informatics.

Kai Ton Chau is Associate Professor and the Jack Van Laar Endowed Chair of Music and Worship at Kuyper College in Grand Rapids, Michigan. He directs the college choir and ensemble, teaches several music courses, and chairs the Arts and Sciences department. His diverse career in Hong Kong, Canada, and the United States has afforded him the opportunities to serve at various churches, inter-church events, mass choirs, and institutions of higher education (including Institute for Christian Studies in Toronto, and Redeemer University College in Ancaster, Canada). Chau earned an Honors diploma in composition at the Hong Kong Baptist University, a Master of Music in choral conducting at the University of Missouri-Kansas City, an MBA from Laurentian University in Ontario, Canada, and a doctorate in worship studies from the Robert E. Webber Institute for Worship Studies in Orange Park, Florida. He also holds professional designations (CGA, FCCA, CFP) in accounting and financial planning from Canada and the U.K.

Elaine Chew is Professor of Digital Media at Queen Mary University of London. A pianist and operations researcher by training, her research centers on the mathematical and computational modeling of aspects of performance, including music prosody, cognition, structure, and interaction, so as to make explicit what it is that musicians do, how they do it, and why. Previously, she was an Assistant then Associate Professor at the University of Southern California, where she founded the Music Computation and Cognition Laboratory; and, she held visiting positions at Harvard University and Lehigh University. Her research has been recognized by the US National Science Foundation Faculty Early Career Development Award and the Presidential Early Career Award in Science and Engineering, and a fellowship cluster on Analytical Listening through Interactive Visualization at the Radcliffe Institute for Advanced Study. She received PhD and SM degrees in Operations Research at MIT, a BAS in Mathematical and Computational Sciences (honors) and in Music (distinction) at Stanford, and FTCL and LTCL diplomas in Piano Performance from Trinity College, London.

Shlomo Dubnov is director of the Center for Research in Entertainment and Learning at University of California San Diego. He teaches in the Music and Interdisciplinary Computing in the Arts programs. Previously, he was a researcher at the Institute for Research and Coordination of Acoustics and Music (IRCAM) in Paris, and head of the multimedia track for the Department of Communication Systems Engineering at Ben-Gurion University. He is a senior member of IEEE and secretary of IEEE's Technical Committee on Computer Generated Music. He graduated from the Jerusalem Music Academy in composition and holds a doctorate in computer science from the Hebrew University, Jerusalem.

Alexandre R. J. Francois is a software engineer and an independent researcher, whose work has focused on the modeling and design of interactive (software) systems, as an enabling step towards the understanding of perception and cognition. His interdisciplinary research projects explored interactions within and across music, vision, visualization and video games. He was a 2007-2008 Fellow of the Radcliffe Institute for Advanced Study at Harvard University; a Visiting Associate Professor at Harvey Mudd College; a Visiting Assistant Professor at Tufts University; and, a Research Assistant Professor at the USC Viterbi School of Engineering. Prior to that, he was a Research Associate with the USC Integrated Media Systems Center and Institute for Robotics and Intelligent Systems. He holds PhD and MS degrees in Computer Science from USC, the Diplôme d'Etudes Approfondies (MS) from the University Paris IX - Dauphine (France), and the Diplôme d'Ingénieur from the Institut National Agronomique Paris-Grignon (France).

Newton Lee is CEO of Newton Lee Laboratories LLC, president of the Institute for Education, Research, and Scholarships, founding editor-in-chief of ACM Computers in Entertainment, and adjunct professor at Woodbury University. Previously, he was a research scientist at AT&T Bell Laboratories, senior producer and engineer at The Walt Disney Company, research staff member

at the Institute for Defense Analyses, and research scientist at Virginia Tech Library Systems. Lee graduated Summa Cum Laude from Virginia Tech with a B.S. and M.S. degree in Computer Science, and he earned a perfect GPA from Vincennes University with an A.S. degree in Electrical Engineering and an honorary doctorate in Computer Science. He is the co-author of *Disney Stories: Getting to Digital*; the author of the Total Information Awareness book series including *Facebook Nation* and *Counterterrorism and Cybersecurity*; and the editor of the Digital Da Vinci book series including *Computers in Music* and *Computers in the Arts and Sciences*.

M. Nyssim Lefford is visiting senior lecturer at Luleå University of Technology in Sweden. Previously, she was visiting assistant professor at Georgia Institute of Technology. Her investigations have ranged from record production to installation art to music cognition research. She has sought to understand how creators create, to find ways to facilitate the creative process, and to uncover the potential in new technology and new perspectives to shape future creations. She received her Ph.D. and M.S. from the MIT Media Lab, and her Bachelor of Music in music production and engineering and film scoring from Berklee College of Music.

Anton Nijholt started his professional life as a programmer at TNO-Delft. He studied civil engineering, mathematics and computer science at Delft University of Technology and did his Ph.D. in theoretical computer science at the Vrije Universiteit in Amsterdam. He held positions at the University of Twente, the University of Nijmegen, McMaster University (Canada), the Vrije Universiteit Brussels (Belgium), and at NIAS in Wassenaar. During some years he was scientific advisor of Philips Research Europe. Presently he is member of the Human Media Interaction group of the University of Twente. His main research interests are multi-party interaction, multimodal interaction, brain-computer interfacing and entertainment computing.

Mustafa Radha is a graduate student in Human-Media Interaction at the University of Twente. He is mainly interested in the social and computational semiotics of augmented human life.

Dennis Reidsma is Assistant Professor at the Human Media Interaction group and Lecturer of the Creative Technology curriculum at the University of Twente. After receiving his MSc degree in Computer Science cum laude for a thesis on semantic language processing, Dennis Reidsma completed his PhD degree at the Human Media Interaction group of the University of Twente. He supervises a number of BSc, MSc, and PhD students on topics of computational entertainment and interactive playgrounds, runs several research projects in this area, and is regularly involved in the organization of conferences such as INTETAIN and ACE. In addition, he has published many papers on interaction with Virtual Humans, and consolidated the results of this joint work with Herwin van Welbergen in the release of Elckerlyc, a state-of-the-art Open Source software platform for generating continuous interaction with Virtual Humans.

Isaac Schankler is a Los Angeles-based composer and improviser. He co-directs the concert series People Inside Electronics and teaches music technology at the University of Southern California (USC). He has published in the International Journal of Arts and Technology, Computer Music Journal, and the proceedings of international conferences including MCM (Mathematics and Computation in Music), ISPS (International Symposium of Performance Science), and ICME (International Conference on Multimedia & Expo). He also writes a regular column at NewMusicBox, the online publication of New Music USA. He completed his doctoral studies in composition at the USC Thornton School of Music, and holds degrees in composition (MM, BM) and English (BA) from the University of Michigan.

Greg Surges makes electronic music, software, and hardware. His research and music have been presented at SMAC/SMC, the International Computer Music Conference, NIME, the SPARK Festival in Minneapolis, and the SEAMUS National Conference. He is currently a PhD student at the University of California, San Diego. Previously, he earned a MM in Music Composition and a BFA in Music Composition and Technology at the University of Wisconsin – Milwaukee. He currently lives in San Diego, CA with his wife and cat.

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