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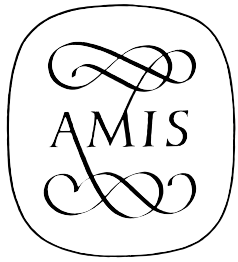

umentary evidence, but marks on soundboards show the design of bridges, which imply the scaling. Poletti is very inventive and can figure out ways of arriving at what he wants to do, and he demonstrates some techniques. But some of his terminology seems to me misleading. His first footnote (p. 273) says that " 'Pythagorean proportions' means a scale in which the octaves halve and double precisely in length, and the length of each successive note [meaning minor seconds] is related to the previous by the 12th root of 2. Such a scale is also called 'Just.' " I understand that instrument makers tend to use "Pythagorean" and "Just" as equivalent in stringing design, but I think this is somewhat sloppy terminology, as you cannot equate them in tuning. And Poletti confuses the difference between scaling and tuning with his "12th root of 2," a tuning concept having to do with the pitches of equal temperament. If he means that you distribute the difference in string lengths between the octave notes equally among the intervening strings, that would, I understand, correspond to normal practice. But that is not the 12th root of 2, which entails multiplication, not addition, and a gradation of vibration-rate differences. And Pythagoras never dealt with the chromatic scale. Much of what Poletti says later about arriving at scales seems to me excellent, quite apart from its putative relation to Pythagoras.

The book closes with Michael Latcham's summary of three round table discussions, one on obtaining appropriate leather, one on obtaining appropriate wire, and the third on instruments appropriate to Haydn's sonatas. The first two are very difficult problems, and the third has several probable answers.

We are closer to understanding eighteenth-century keyboard instruments with this book than we were before, but the picture is not yet definitive. But when can anyone claim a definitive answer to a general historical subject like that?

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Trevor Pinch and Frank Trocco. *Analog Days: The Invention and Impact of the Moog Synthesizer*. Cambridge, MA: Harvard University Press, 2002. xv, 368 pp.: 56 black-and-white photographs, discography. ISBN: 0-674-00889-8. $29.95 (cloth).

***Moog: A Documentary Film*. DVD. Written and directed by Hans Fjellestad, produced by Ryan Page and Hans Fjellestad. Brooklyn: Plexifilm,**

2005. 70 minutes, with 47 minutes of bonus footage; Arturia™ Minimoog V software, fully functional demo (Mac, PC). $24.98.

Analog Days: The Invention and Impact of the Moog Synthesizer covers the musical, social, technological, and economic issues surrounding the invention of the Moog synthesizer. It also includes information concerning the development of other early analog synthesizers such as the Buchla Box, ARP 2600, and VCS3. Pinch and Trocco effectively convey the atmosphere in which each synthesizer was developed and the goals and methods of the inventors, salespeople, and performers involved. Robert Moog's Trumansburg factory was a relaxed, "funky" environment in which engineers and inventors dressed casually and worked enthusiastically on their various projects, while Don Buchla's factory was intimidating because there were few lights and the workers were not allowed to talk. Alan Robert Pearlman's ARP factory was run like a business, with employees wearing suits and working hard to sell their products, while Peter Zinovieff's EMS (Electronic Music Studios) headquarters was a luxurious, comfortable place where rock stars and composers dined together—the synthesizers were manufactured elsewhere. Like the environments in which they were developed, each synthesizer was very different.

Analog Days stresses the importance of the interaction between humans and instruments. Moog's keyboard synthesizer was more successful than Buchla's keyboardless one because it was more appealing to musicians. The flaws in the construction of the Moog synthesizer and the imperfection of human performance are affectionately cited as defining characteristics of the analog era. Especially interesting (if sometimes slightly far-fetched, in my opinion) is the discussion of the relationship between women and synthesizers. Pinch and Trocco mention Suzanne Ciani's admission of romantic love for her Buchla 200 synthesizer, and they suggest that Walter (later Wendy) Carlos's involvement with the Moog synthesizer may have helped him escape from the reality of his gender. After the success of *Switched-On Bach* (Columbia Records, 1968), part of his identity was forever bound to a machine. Ciani feels that women approach technology in a more open-minded manner than men, because they are supposedly more patient with electronic devices and approach them with fewer preconceptions.

Pinch and Trocco are able to move among several musical genres effectively, a requirement for any adequate discussion of early synthesizers.

Rock musicians (Keith Emerson), soul artists (Stevie Wonder), composers for commercials and other electronic media (Suzanne Ciani), and early electronic experimenters (Wendy Carlos, Paul Beaver, Bernie Krause) are all presented as pivotal figures in the development of electronic music. The authors clearly understand popular music and experimental music. No single style of popular music or concert music is given preferential treatment, but commercially successful albums such as *Switched-On Bach* are discussed in detail because of their impact on popular culture.

An advanced understanding of the technical aspects of electronic music is not necessary for the majority of the book, but there are brief sections that will appeal only to specialists. The authors generally limit their use of advanced technical language to two major areas. The first concerns the major electronic innovations on the synthesizer that are linked to important musical changes in popular music; one such example is Keith Emerson's use of portamento effects in "Lucky Man." The second area concerns the technological differences between the major brands of synthesizers in the early 1970s. For instance, the oscillators on Perlman's ARP synthesizer were more stable than those on Moog's early synthesizers, and thus Perlman's instruments had fewer tuning problems. For the non-specialist, there is a glossary of important terms, such as oscillator, portamento, envelope, and filter.

Pinch and Trocco discuss many well-known musicians in the book, but they also pay attention to lesser-known figures in the history of the synthesizer. An entire chapter is devoted to the career of David Van Koevering, an important salesman of Minimoog synthesizers during the early 1970s. Also discussed are little-known inventors who worked for the major companies. Robert Moog invented the earliest models of the Moog synthesizer and provided the basic framework of the instrument, but the portable Minimoog was developed by Bell Hemsath. The authors explain the importance of Hemsath's invention and describe the willingness and determination of salesmen such as Koevering to promote it. This attention to behind-the-scenes figures is one of the book's strengths.

The transition from analog to digital synthesizers is discussed only briefly—the book is more a celebration of analog synthesizers than a discussion of a historical phenomenon that has been superseded. The perfection of digital technology and the use of sampling mark the beginning of a new era in electronic music, but the authors look back

affectionately on the analog era and they discuss the analog revival of the 1990s and beyond.

Analog Days is a worthwhile purchase for anyone interested in the Moog synthesizer or other early electronic instruments, and its thoroughness insures that most readers will learn a great deal from it. The book provides a good introduction to those just beginning to learn about analog synthesizers, and many photos are included. Those with a background in analog synthesizers will also undoubtedly learn a good deal, especially concerning the lesser-known pioneers. The Moog synthesizer was one of the most important inventions in twentieth-century music, and *Analog Days* is an important study.

Hans Fjellestad's documentary, *Moog*, is an excellent companion piece to *Analog Days*. Most of the film is built around interviews with Robert Moog. Artists such as Rick Wakeman and Bernie Worrell are also interviewed, and Keith Emerson, Stereolab, and others are seen in live performance. Emerson's performance on an early modular Moog synthesizer (as opposed to the much more popular Minimoog) is particularly interesting. Wendy Carlos, the composer of the pioneering album *Switched-On Bach*, was not involved with the film and no photos of her are shown. *Switched-On Bach* was the first album to bring the sound of the Moog synthesizer to large audiences, and her absence from the film is a noticeable weak point. In the liner notes Fjellestad claims that Carlos refused involvement.

Fjellestad clearly sought to show Moog as an unassuming genius. The most extensive interview was conducted at Moog's modest home in North Carolina, where he is seen on his front porch, in his kitchen, and in his garden; his humility is refreshing, and he comes across as a family man in love with nature, not as a man obsessed with machines or money. It becomes difficult for the viewer to fathom the controversy and suspicion that surrounded both him and the Moog synthesizer in the mid-1960s. Moog was clearly a hobbyist who managed to stumble upon a lucrative market.

Moog briefly explains the inner workings of one of his instruments, and there is a good deal of classic synthesizer footage throughout. Moog's expertise was in electronics, but he was incessantly concerned with the interaction between instruments and live performers. He consulted with many musicians concerning the sounds and effects on his synthesizers during the 1960s and '70s, and he often took their advice. Moog valued human interaction in the music-making process, and he

was intrigued by the fact that many musicians were able to use his instruments instinctively. He regretted that musicians were increasingly creating music in isolation, and he viewed group collaboration as essential to a socially healthy environment. His early detractors clearly misunderstood his personality and intentions.

Fjellestad effectively displays a good mix of classic footage and modern uses of the Moog synthesizer. A classic presentation by Gershon Kingsley's synthesizer quartet from the late 1960s is included alongside a modern performance by Money Mark (on Moog synthesizer and drum machine) and the DJ Mix Master Mike. Keith Emerson, who started using synthesizers in 1970, is shown playing a modular Moog synthesizer in a modern setting, to the approval of an appreciative audience. The Moog synthesizer is presented throughout as a contemporary instrument rather than an outdated one; many performers have rejected modern digital sounds in favor of the classic analog sounds, a trend remarked by Fjellestad as well as by Trocco and Pinch.

Moog built, played, and sold theremins before he invented his synthesizers. His interest in theremins never subsided, and he continued to build and sell them. *Moog* concludes with a performance of "Ol' Man River" by Moog on a theremin. Moog was excited to learn that four Japanese women were devoting themselves to the extensive study of the theremin. His enthusiasm is touching, and it is clear that he desperately yearned for electronic instruments to be taken seriously in the concert hall.

Robert Moog is the most important inventor in the history of analog synthesizers, and Fjellestad's entertaining and informative documentary is the most thorough portrait of him available. But the film's impact will probably be strongest on those with a general knowledge of the history of the Moog synthesizer. *Analog Days* is a better place for the uninitiated to start, as the lesser-known figures who make brief appearances in *Moog* (such as Herb Deutsch, Gershon Kingsley, and Walter Sear) are discussed in detail in Pinch and Trocco's book.

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Bettina Wackernagel. *Musikinstrumentenverzeichnis der Bayerischen Hofkapelle von 1655: Faksimile, Transkription und Kommentar*. Veröffentlichungen der Gesellschaft für Bayerische Musikgeschichte. Tutzing: Hans