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## Tinkering with Cultural Memory

*Gender and the Politics of Synthesizer Historiography*

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**ABSTRACT** In 2015, analog synthesizers are resurgent in popular appeal. Robert Moog is often celebrated as the central and originary figure who launched a so-called revolution in sound by making synthesizers widely available in the late 1960s and early '70s. This essay examines the figure of the humble tinkerer, as exemplified by Moog, along with other historically specific and archetypal forms of masculinity that are embodied by the male subjects at the center of electronic music's historical accounts. Critical readings of audio-technical discourse, and of the periodization of synthesizer histories, reveal that women are always already rendered out of place as subjects and agents of electronic music history and culture. Yet a set of letters, written by young women across the United States to Harry F. Olson at the Radio Corporation of America (RCA) in the mid-1950s and analyzed in this article, demonstrates that women were an enthusiastic audience for the RCA synthesizer a decade before Moog built his prototypes. As they did with new media, including wireless radio and the phonograph, in the early twentieth century, women played a key role at midcentury in enabling the broad-based market for analog synthesizers that greeted Moog and others in the 1960s once these instruments were made available for widespread use. **KEYWORDS** analog, electronic music, feminist historiography, history of technology, synthesizer

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Synthesized sounds are ubiquitous in contemporary music and aural environments around the world.<sup>1</sup> Analog synthesizers in particular hold resurgent appeal: as Trevor Pinch and Frank Trocco note in their book on the Moog synthesizer, an “analog revival” was underway by the early 2000s.<sup>2</sup> In an era of digital connectivity, musicians and music technologists are demonstrating widespread enthusiasm for a return to the synthesizer styles of the 1970s, complete with unpredictable sounds, networks of patch cables, and wood-paneled designs. Over the past few years, this analog revival has become a full-blown renaissance. Synthesizer keyboards, along with DJ gear, saw the largest gains in U.S. sales in 2013 compared to the previous year among all music product segments.<sup>3</sup> The National Association of Music Merchants (NAMM) trade show, a premier

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annual event for music manufacturers to showcase new products to industry colleagues and the public, announced that synthesizers were “tak[ing] the 2015 NAMM show by storm,” with a 20 percent increase in that product segment’s offerings compared to the 2014 show.<sup>4</sup> A write-up of this NAMM event on a music technology blog characterizes it as “an avalanche of modulars,” referring to the genre of customizable synths that are made up of interconnected units devoted to distinct tasks.<sup>5</sup>

Some historians of technology have proposed that the pervasiveness of synthesizers and the “origins of this electronic soundscape can be traced to one engineer, Robert Moog,”<sup>6</sup> who is celebrated as a humble tinkerer and folk hero of analog synthesis.<sup>7</sup> As is often the case in histories of music and technology, one man is figured as launching a revolution in sound. Moog’s innovations in synthesizer design and marketing beginning in the late 1960s were indeed significant. But, curiously, popular documentaries, journalistic writings, and scholarly studies alike tend to replicate the Moog company’s public relations rhetoric by placing him at the center or beginning of historical accounts of the synthesizer.<sup>8</sup>

This essay explores how gender informs the historiography of electronic music and synthesizer technologies by examining the politics of periodization in existing histories and associated assumptions about who counts as a subject of historical accounts. Throughout, I employ various approaches to doing feminist media history in a field where women are routinely omitted from existing histories: I analyze the gendered subjects of historical accounts and read discourses for those figures who are backgrounded or absent; I frame and reframe histories of technology by examining multiple, overlapping, and sometimes long periods of time; and I provide an example of how serendipitous finds in archival research can shift received narratives. I argue that young women represented an enthusiastic audience for synthesizers in the 1950s, pointing the way toward general acceptance of these instruments once they became widely available in the late 1960s.

#### **FRAMING SYNTHESIZER HISTORY: THE PAST CENTURY**

The origins of synthesized sound, on conceptual and technical levels, extend back at least to the 1800s, catalyzed by Hermann von Helmholtz’s research on acoustics and perception and the emergence of various electronic tone-producing devices and instruments for music and telecommunications.<sup>9</sup> In the 1890s, the inventor Thaddeus Cahill drew upon Helmholtz’s ideas in combination with novel techniques of electronic tone generation when developing his Telharmonium instrument. In his 1897 patent, Cahill wrote of the “electrical vibrations corresponding to the different elemental tones desired” and claimed, “Out of

them I synthesize composite electrical vibrations answering to the different notes and chords required.”<sup>10</sup> His Telharmonium was arguably “the first synthesizer” utilized for musical purposes.<sup>11</sup> While a handful of electronic musical instruments that emerged in the early decades of the twentieth century can be considered as precursors to the modern synthesizer,<sup>12</sup> it was not until midcentury that the terms *synthesis* and *synthesizer* were more consistently applied to such musical devices. Following advances in speech synthesis techniques in the 1930s and 1940s<sup>13</sup> and drawing on cybernetic theories, engineer Harry F. Olson and his colleagues at RCA Laboratories in Princeton, New Jersey, brought the fields of music and communication together in their research and development of RCA’s synthesizer instruments in the 1950s.<sup>14</sup> In the 1960s, Robert Moog, Don Buchla, and other inventors took advantage of the introduction of transistors to replace the bulkier vacuum tubes used in electronic musical instruments of previous decades. Moog, in particular, developed synthesizer instruments that had popular appeal by harnessing the process of electronic sound synthesis to a familiar keyboard interface.<sup>15</sup> While the rise in synthesized sound’s popularity as such is often associated with Moog’s inventions and marketing efforts, the sounds of RCA synthesizers had captivated the public imagination at least a decade before Moog built his prototypes.<sup>16</sup> And, in the 1950s, young women composed a noteworthy audience for synthesizers and were eager to embrace these new technological possibilities in music making. Before turning to a discussion of these women synthesizer enthusiasts of the 1950s, however, I examine historically specific and longstanding archetypal forms of masculinity that are embodied by the male subjects at the center of electronic music’s historical accounts and the various ways that women are always already rendered out of place as subjects and agents of history and culture.

#### **FROM MEN IN LABORATORIES TO MILLENNIAL COOL: READING THE SUBJECTS OF ELECTRONIC MUSIC HISTORY**

Feminist music scholars have accounted for the ways that “electronic music is . . . a culmination of two male domains, composition and technology,”<sup>17</sup> demonstrating that “overwhelmingly, women have been marginalized in fields where creative work in sound and music meets technology.”<sup>18</sup> Women have been left out of scholarly histories and anthologies of electronic music and music technologies, are absent in popular documentaries on these subjects, and remain minimally present on major festival and label rosters despite their vibrant, creative activities internationally as DJs and electronic music producers.<sup>19</sup> Sexism also persists in audio cultures: women’s bodies

continue to be used in advertisements to sell audio gear and sometimes are even displayed as part of the interface of digital audio tools. These now-familiar visual tropes presume and address a heterosexual male gaze and sustain fantasies of control of sound through feminized machines.<sup>20</sup> Additionally, online forums for knowledge-sharing in music production are routinely hostile places for women and queer participants, with cheap misogynistic comments a predictable dimension of their discourse.<sup>21</sup>

A well-known challenge for historians of marginalized subjects is that cultural materials tend not to survive or be preserved in institutional archives. In the case of electronic music, histories have become slightly more inclusive of women composers in recent years, in part because of the new availability of archival materials from artists such as Daphne Oram and Delia Derbyshire.<sup>22</sup> Unfortunately, the release of archival materials to the public often comes only after an artist's death, and their work is recognized mainly posthumously. Moreover, women who have archives of their own have typically occupied positions of racial and economic privilege, holding university positions or institutional affiliations (such as at the BBC) at times when few women had those opportunities. So, even as historical accounts begin to include some women, this expansion happens in small steps and in uneven ways across race, class, and culture.

Relatively new or nontraditional genres of music may themselves be marginalized or not prioritized in the collecting practices of institutions. For example, archival materials of lesser-known figures in electronic and experimental music cultures, if they survive at all, are sometimes left in the hands of volunteer collectives or nonprofit organizations that may be well intentioned but lack the space to keep materials and the library and information-science expertise to sort and preserve materials systematically. There can be a troubling cycle in which cultural production that is already deemed to be important (by virtue of cultural, racial, gendered, and classed forms of privilege) results in the preservation of associated materials in archival collections while the converse is not true. Work that is not understood as significant may not even be saved, and therefore it can never reach a point where it would become the subject of scholarly analysis or historical accounts and would be recognized for its cultural value. For example, if a relatively unknown woman composer's work remained obscure during her lifetime—which may have less to do with the work's merits than with gendered expectations and norms of the time—her extensive technical notes and scores, which document substantial creative work and knowledge, may be cast aside as “unimportant” simply because her work was not widely circulated. We may find snippets of her work showing up here or there—one track

on a compilation album, or a single score—but it remains stray noise rather than the primary signal in historical accounts.

A dearth of primary source materials can result in historical narratives that, if they depict women at all, portray them as isolated exceptions to the norm rather than as key contributors to the development of electronic music cultures. As Abi Bliss has argued, emerging narratives of women who are “sonic pioneer[s] from decades ago” have begun to take a familiar form wherein “the lone woman who shuns the conventions of her era and dedicates herself like a kind of patchbay-nun to uncovering the mysteries of sound . . . plays easily into the fetishisation of outsider figures” in experimental music cultures. These women tend to be portrayed as “oddities and exceptions to the rules of their times” and are cordoned off from mainstream narratives of electronic and experimental music history.<sup>23</sup> A companion form of popular historiography to the patchbay-nun tales are the *Buzzfeed*-style lists, such as “10 Female Electronic Music Pioneers You Should Know” and “7 Visionary Women Who Paved the Way for Electronic Music,”<sup>24</sup> which deliver all we apparently need to know in X easy steps, usually fewer than a dozen but enough to get us to click through several pages of targeted ads. For all the promise of lists like these in educating the public and getting hundreds of shares and retweets, there are obvious limitations to the form. The naming of only ten or so “pioneers” is inevitably followed by a raucous comments section in which participants name key artists who have been left out. What may start as a well-meaning effort to account for and celebrate women as visionary contributors to the culture ends up, through the constraints of the format, becoming a collective performance of resignation to the ways that such a celebratory effort falls short. The performative online “X Women You Should Know” genre can thus replicate the effects of that pervasive trope in feminist media history: the catfight. An initially positive feminist move is depicted as an irreconcilable struggle between women or feminist allies who disagree, and the takeaway is the consumption of a public spectacle of bickering that distracts from, and ultimately deflates, the merits of the original content.<sup>25</sup> That these lists are a recurring and highly visible Internet phenomenon functions as a mode of constraint on imagining the place of women in electronic music history. We are encouraged to recall or learn about only those ten (or twelve or seven) and, to Bliss’s point, to consider these women as exceptions to cultural norms and as working in isolation from one another.

One strategy to counteract this constraint is to compile new archives that offer building blocks for alternative narratives of electronic music history. This is the impulse behind the *Pink Noises* project, a collection of twenty-four interviews

and a discography that I published in 2010, and behind projects such as the Her Noise Archive in London and the female:pressure *Visibility* Tumblr.<sup>26</sup> Another strategy is one I have adopted in researching the history of synthesized sound: if there are limited places to look for archival materials that document gender, racial, and other forms of social and cultural diversity in electronic music, we can also read discourse for the ways that these absences are naturalized and justified.

I argue elsewhere that the use of wave metaphors in audio-technical discourse aligns the physical properties of sound waves with the connotations of fluidity and excess that have been associated with female bodies throughout western history and philosophy.<sup>27</sup> From accounts by acoustics researchers in the nineteenth century through technical literature on the aptly named “Odyssey” and other analog synthesizers of the 1970s, to analyze and control sound has meant to experience the pleasure and danger of unruly waves and to seek their control from a distanced perspective. The objectified material of sound, as well as the subject positions of acoustics researcher, music technologist, and sound composer, is gendered. Through themes of maritime voyage and discovery in audio-technical discourse, the experiential navigation and technological control of sound waves are articulated to colonialist paradigms of racial and sexual exoticism and conquest. This powerful and persistent audio-technical imaginary naturalizes the kinds of headlines that open this essay: imagine, once again, an “avalanche” of modular synthesizers taking the industry “by storm”—and the daunting yet pleasurable implications for the male subjects who are the “sound ‘geeks’ rid[ing] music’s latest wave.”<sup>28</sup> These tropes contribute to rendering women—who are ever-present as composers, inventors, and electronics tinkerers—ever out of place as subjects of critical and historical accounts.

Visual cultures of electronic music—from magazine covers to flyers to photographs in books—also establish particular figures as the normative subjects of electronic music. The masculinities that occupy these subject positions are indeed multiple and vary across eras and contexts. For example, histories and textbooks are full of photographs of midcentury men at the helm of room-size computers and early synthesizers, which were typically “the preserve of men in laboratories.”<sup>29</sup> Twenty-first-century magazines and websites update this image to a more contemporary male figure—perhaps wearing a stylish parka and mirrored sunglasses—bent over a laptop or synthesizer in performance or simply looking out of frame with a certain brand of millennial cool (fig. 1).<sup>30</sup> While representations of women have not increased significantly over many decades, representations of racial and cultural difference in these forums have changed in nuanced ways. The images of men in laboratory and academic or broadcast-studio settings signaled

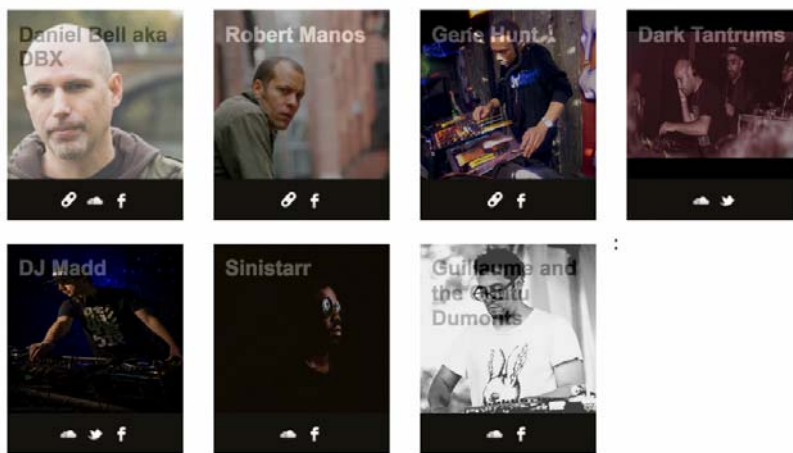


FIGURE 1. Screenshot of selected artists from the Forward DC festival of electronic music and culture, 2015. (From [www.forwarddc.com/artists.html](http://www.forwarddc.com/artists.html).)

the whiteness of these forms of institutional access and privilege. By contrast, representations of turn-of-the-twenty-first-century electronic music cultures trade in an investment in Black and Latino roots of particular genres;<sup>31</sup> an array of cultural styles inflect music, graphic design, and fashion aesthetics. As Beth Coleman notes in our interview for *Pink Noises*: “Even the more underground electronic music magazines, I felt like they started out with the initiative that this is about cultural mix. All these places understand that sampling something about hip-hop culture, and hip-hop style, is a mandate. It doesn’t even have to be a Black face anymore.”<sup>32</sup> The dynamics of racial difference and cultural appropriation remain largely unproblematized in contemporary discourses and representations of electronic music cultures.<sup>33</sup> And yet the fact that many of the white male subjects who appear on magazine covers and in other forums are adopting nonwhite or multicultural aesthetics inflects what constitutes hegemonic masculinity in visual cultures of electronic music. A particular form of millennial white masculinity emerges whose cultural power is defined and constituted in part by its (unacknowledged, if knowing) appropriation of racialized and/or cultural otherness as well as by a generalized absence of women subjects. This unmarked, white, and male subjectivity is arguably supported by the backgrounded labor of others: for example, musical innovators from various cultural traditions whose sounds may be sampled but who are unacknowledged and uncompensated, and women in electronics and musical instrument manufacturing whose work enables the swift pace of technological “innovation” in audio-technical and computing cultures

that are characterized by profit-oriented cycles of planned obsolescence.<sup>34</sup> While what I describe in shorthand as “men in laboratories” and “millennial cool” are historically specific expressions of masculinity, a longer view of the history of music and technology reveals that certain archetypal white, western, male figures serve as their foundation.

#### REFRAMING SYNTHESIZER HISTORY: FROM THE BEGINNING OF TIME . . .

Reading around the edges of acoustics textbooks and synthesizer and electronic music histories, one uncovers telling epigraphs that situate technological progress in electronic music cultures within a grand narrative of western history, where modern science fulfills a lineage that begins with ancient, Judeo-Christian, and early modern texts. The most prominent and recurring example of this is a passage on sound from Francis Bacon’s seventeenth-century utopian travel narrative *New Atlantis* that appears in countless electronic music histories and acoustics textbooks.<sup>35</sup> An excerpt reads: “We have also sound-houses, where we practise and demonstrate all sounds and their generation. . . . We represent and imitate all articulate sounds and letters, and the voices and notes of beasts and birds.”<sup>36</sup> Bacon’s *New Atlantis*, with its maritime context and biblical undercurrents—including allegorical references to creation stories in the Book of Genesis—has become a prominent origin story of synthesized sound, with Bacon himself, the “father of modern science,” invoked as a patriarchal figure across these texts. Many twentieth-century inventors, composers, and educators cited this passage to situate their work within a history of scientific experiment that signifies, at once, rationality and adventure. They attached their endeavors to the promise held out by this tale of technological utopia: that the establishment of dedicated studios (“sound-houses”) would foster knowledge and mastery of new technologies for producing any sound imaginable through the application of scientific inquiry.

Another epigraph useful for understanding these discourses of technological mastery and control is the one introducing the opening chapter of Robert Beyer’s *Sounds of Our Times*, an acclaimed history of acoustics research from 1800 onward. Excerpted from the Book of Wisdom in the Bible, this passage claims an ancient (to be read as timeless) world of sounds in nature as the proper domain of inquiry for modern acoustics:

The sighing of the wind,  
the tuneful noise of birds in the spreading branches,  
the measured beat of water in its powerful course,



the harsh din of the rocky avalanches,  
the invisible swift course of bounding animals,  
the roaring of the savage wild beasts,  
the echoes rebounding from the cleft in the mountains.<sup>37</sup>

Interestingly, Beyer leaves out the last and unsettling line that follows this litany of sounds: “All held them paralysed with fear.”<sup>38</sup> This is a telling omission, one that reveals a dominant perspective in audio-technical discourse about fantasies of and desires for a world of sonic beauty and complexity, the technological possibilities for its creation and control, and the suppression through technological control of any fears of uncontrollable “nature.”

A modern, material fulfillment of the mythic soundscape anticipated in the Book of Wisdom and *New Atlantis*, patch books for commercial synthesizers produced after 1970 include instructions for producing the sounds of wind, water, and diverse animals, as well as echo and reverberation effects.<sup>39</sup> The genesis of sounds of all creation is thus placed within reach of an archetypal god/man/composer/technologist. Its promise is perpetually expressed over many decades in audio-technical discourse by a desire to use electronic synthesis to “produce every known or conceivable sound,”<sup>40</sup> “any kind of sound that can be imagined,”<sup>41</sup> with the exhilarating possibility of creating a “world of sound in a nutshell,”<sup>42</sup> “with a multiplicity of sound parameters under his control [to] produce the desired results.”<sup>43</sup>

Taking this long view of synthesizer history—playfully, we’ll say from the beginning of time to the present—reveals how the figure of the composer or technological innovator who creates these worlds of sound is always already figured as a man, in the same ways that, more generally in western Judeo-Christian creation narratives (which are intimately entwined with western technoscientific discourses), the all-knowing subject of science is normatively white, western, and male.<sup>44</sup> These deep-seated norms are at the root of the ongoing dissonance between the words *woman* and *composer*, or *woman* and *inventor*. And so, despite the ongoing presence of women in electronic music history—Pauline Oliveros, Eliane Radigue, Daphne Oram, Delia Derbyshire, Yoko Ono, Pamela Z, Laurie Spiegel, K. Hand, and more—it has too often been dissonant or even unthinkable for many cultural participants, scholars, and critics to recognize women fully, on their own terms, as creators and innovators.

#### THE “HERO” OF THE OCCASION: A HUMBLE TINKERER

Robert Moog’s popular and portable synthesizer instruments met with widespread enthusiasm in the 1960s; in 1969, the *New York Times* announced that “the Moog music synthesizer . . . is coming to stand in the public’s mind for all

music synthesizers.<sup>45</sup> The Moog company sought to brand itself with this kind of universal recognition, as evidenced in a 1979 advertisement in *Contemporary Keyboard* magazine: a photo of the Minimoog, the portable synthesizer introduced in 1969, is accompanied by neither the company's nor the instrument's name, only the caption "You know what this is . . . because you hear it everywhere."<sup>46</sup> Even more so in retrospect, Moog's innovations have been celebrated as a revolutionary moment in the history of musical instruments and a foundational moment of the contemporary electronic soundscape, as in this account:

Something remarkable happened between 1960 and today. The world back in 1960 was a lot quieter. . . . Today, however, we are saturated with electronic sound. . . . The origins of this electronic soundscape can be traced to one engineer, Robert Moog (known affectionately by everyone in the field as Bob Moog) and his invention of the synthesizer. . . . Much of the technology for making new electronic sounds is descended from this first commercial device for making electronic music, the Moog synthesizer.<sup>47</sup>

In their important study of the invention and impact of the Moog synthesizer, Pinch and Trocco emphasize that the popularization of synthesizers formed part of a "revolution in sound" in the 1960s. The authors suggest that when Moog was building his prototype synthesizer in 1964, "working with synthesizers was seen strictly as a weird and marginal activity" carried out by esoteric, avant-garde composers, and "it was not at all clear that the synthesizer would appeal to a mass market."<sup>48</sup> Elsewhere, the authors assert: "The advent of the synthesizer is one of those rarest moments in our musical culture, when something genuinely new comes into being."<sup>49</sup>

These accounts bear a notable resemblance to the version of history that has long been promoted by Moog's company and associates. Advertising copy for the Minimoog reads:

R. A. Moog, Inc. built its first synthesizer components in 1964. At that time, the electronic music synthesizer was a cumbersome laboratory curiosity, virtually unknown to the listening public. Today, the Moog synthesizer has proven its indispensability through its widespread acceptance. Moog synthesizers are in use in hundreds of studios . . . throughout the world. . . . The basic synthesizer concept as developed by R. A. Moog, Inc., as well as a large number of technological innovations, have literally revolutionized the contemporary musical scene, and have been instrumental in bringing electronic music into the mainstream of popular listening.<sup>50</sup>

Here again, Moog's work is promoted as revolutionary and visionary. As the composer and inventor Daphne Oram concluded regarding histories of technology: "I wonder why we want so much to see one man as the hero of the occasion."<sup>51</sup>

The canonization of Robert Moog as a central and beloved figure in the history of synthesizers reflects contemporary investments in the figure of a middle-class, white, male hobbyist who, in the privacy of his basement, found clever ways to harness creative potential in electronic sound by modifying and repurposing component parts of technoscientific industries at midcentury. There is a clear affection among historians and other cultural observers for the humble hobbyist and tinkerer "known affectionately . . . as Bob" who "quietly begin[s] a revolution"<sup>52</sup> in contemporary music. There are, arguably, racialized dimensions to the abundant celebrations of Moog and the elevation of this so-called quiet figure launching a sonic "revolution" over such pioneers of synthesizer use in the 1960s and '70s as Sun Ra, Herbie Hancock, and Stevie Wonder, whose sonic experiments and Afrological polyrhythms were emblematic of rising Black political consciousness and power in the context of civil rights struggles and which were, in both their sonic and political import, far from "quiet."<sup>53</sup> Moog himself, by all accounts, was a reluctant subject of history. In the final years of his life, he reflected on his success and suggested that, given all the contingencies of technological invention and development, he might just as well have gotten where he was by "slipping backwards on a banana peel."<sup>54</sup>

As Ruth Oldenziel has written, "Technology is a narrative production and plot of our own myth making."<sup>55</sup> The term *technology* itself was defined more broadly in the nineteenth century, encompassing a broad range of material practices and social actors. Only in the 1930s did the term become widely used to designate "the useful application of scientific knowledge," as white, middle-class, male engineers were established as the primary bearers of that knowledge. Its formation into such a neutral-sounding term was in fact a social process, contested along lines of gender, race, and class.<sup>56</sup> In the early decades of the twentieth century, white male biographers portrayed the engineer as a middle-class cultural hero who was able to associate with common laborers but also rise to a more powerful management position; in these narratives, working-class and African American male bodies were simultaneously valorized and disempowered, and women were absent altogether.<sup>57</sup>

Alongside the consolidation of engineering as a professional class, various forms of technological enthusiasm took root in popular culture, including a do-it-yourself (DIY) ethos. Technological engagement was taken up by many

as a recreational hobby at home and supported by the circulation of periodicals such as *Popular Mechanics* and *Popular Science*. With the spread of suburbs in the United States, as Steve Waksman has noted, “DIY was driven by two simultaneous impulses: the desire to recover manual labor as the proper realm of masculine activity at a time when many men found themselves part of a growing class of white-collar workers; and the desire to carve out a distinctly masculine sphere within the increasingly isolated, feminized space of the late Victorian suburban home. Tools thus became a key element of suburban masculinity.”<sup>58</sup> Those who “tinkered” with electronics exhibited an “impulse to rearrange technological details”<sup>59</sup> through do-it-yourself projects. Existing scholarly literature thoroughly documents the ways that electronics tinkering and affinity hi-fi audio cultures were generally homosocial, male practices.<sup>60</sup> However, tinkering appropriated certain values of craft hobbies and handwork typically associated with women by emphasizing nonteological explorations and the detailed craft of the handmade. And, as I note in following pages, evidence suggests that women and girls took interest in these same technology-enthusiast magazines and sought the necessary time and resources to carry out projects themselves.<sup>61</sup>

The notion in histories of synthesized sound that an everyman-as-tinkerer could become a great man of history reflects a certain hopefulness and desire that the genius of male invention and innovation might not require formalized training or even intent, but just tinkering at the workbench and an eagerness for exploration and discovery bolstered by the confidence that such experimentation was a worthy pursuit. For men such as Bob Moog and Don Buchla, the freedom to tinker with electronics was in part a reaction against perceived pressures for conformity upon middle-class men in the midcentury workplace. Their hobbyist experiments were defined in opposition to the stifling constraints of formal engineering jobs and concomitant bureaucratic cultures: “They could tinker and experiment freely without the constraints that a corporate setting might have imposed.”<sup>62</sup> With these assumptions of particular forms of freedom—rooted in the time and resources that often accompany white male privilege and representing a socially sanctioned form of rule-breaking—activities that might otherwise be considered amateur pursuits could be recuperated as male innovation and as cultural revolution.<sup>63</sup>

## **UNSUNG HEROES: YOUNG WOMEN AND THE POPULARITY OF RCA SYNTHESIZERS**

Historians’ claims that synthesizers were “virtually unknown to the listening public” or seen as “weird and marginal” before the mid-1960s are challenged by

archival materials on synthesizers developed by RCA in the 1950s, which document the widespread appeal of synthesized sound at least a decade before Moog built his prototypes and developed instruments for a mass market. Engineers Harry F. Olson and Herbert Belar developed two versions of the Electronic Music Synthesizer as part of their work at the RCA Acoustic Research Laboratory, which Olson directed from 1934 until his retirement in 1967.<sup>64</sup> The second synthesizer (the Mark II, or “Victor” Synthesizer) was installed in the Columbia-Princeton Electronic Music Studio by the end of the 1950s and used by music composers and students there. The uses of the RCA Electronic Music Synthesizer in avant-garde and experimental compositions by Milton Babbitt, Otto Luening, and others are well known and documented.<sup>65</sup> However, a case can be made that this synthesizer—that “cumbersome laboratory curiosity” called out in the Minimoog advertisement and likewise dismissed as “a massive and very expensive brute that sat in the . . . laboratory” by a *New York Times* article celebrating the arrival of the portable Moog<sup>66</sup>—was in fact a popular instrument that reached receptive audiences far beyond the avant-garde. Rather than marking the “end of the era of the early electronic instruments,” as the electronic music historian Joel Chadabe suggests,<sup>67</sup> the RCA synthesizer represented a beginning of sorts, in that it helped to consolidate a market of listeners who were interested in synthesized sound and curious about the technicalities of its production.

Although it was never mass-produced and remained unseen in person by most Americans, the circulation of the RCA synthesizer’s sounds on recordings, RCA’s efforts to teach the public about the instrument, and prominent media coverage of its demonstrations brought together a new market of listeners and consumers who embraced synthesized sound as a useful element in music and an acceptable medium of new musical instruments. RCA, anticipating and catering to popular reception of the synthesizer’s sounds, crafted a careful mix of familiar musical selections on the synthesizer’s 1955 demonstration record to appeal to a wide range of listeners.<sup>68</sup> The liner notes to the album contained detailed information on synthesis terms and techniques, including sections titled “The Physical Properties of Musical Tones” and “Synthesis and the Musician.”<sup>69</sup> The record was released as an LP as well as in 45 rpm format so that it could be played in jukeboxes; the LP version sold about 6,500 copies and the 45 several hundred more.<sup>70</sup> The synthesizer was also featured in local and national news reports.<sup>71</sup>

By the mid-1950s, many Americans had heard electronic sounds and were beginning to hear them more often and in more diverse contexts. To name a

few examples: numerous experimental and popular electronic musical instruments were accounted for in a journal article by the inventor Benjamin Meissner in the 1930s; the theremin had been featured in film soundtracks and space-age pop music by the 1950s; Louis and Bebe Barron used their own custom-built analog circuits for the soundtrack to *Forbidden Planet* in 1956; and Raymond Scott's electronic instruments had been heard in numerous commercial jingles by the early 1960s.<sup>72</sup> Through the instructional content on the demonstration record and popular and professional publications on its design, RCA did much to register the terms *electronic music* and *synthesizer* in the public imagination, both of which are commonly used today (and usually associated with Moog's contributions to the field).

Americans were curious to understand how the RCA synthesizer worked—and, as it turns out, many of those who showed interest were women. Soon after a demonstration of the synthesizer was reviewed on the front page of the *New York Times* in 1955 and recordings of its sounds were distributed on the demonstration record through RCA's catalogue, letters of praise and interest poured in from around the United States to Harry F. Olson, the synthesizer's lead developer.<sup>73</sup> He received several letters in 1956 from women in high school and college who expressed interest in the synthesizer and asked questions about its design and societal implications. Letters of inquiry arrived from Doris Dailey, a high school senior who reported that her interest in the synthesizer had been sparked when she received RCA's demonstration LP for Christmas in 1955. Following her research in subsequent months, she went on to win accolades for a presentation on the RCA synthesizer at the Ohio State Science Day.<sup>74</sup> Another letter was sent by Shirley Stroffolino, a student who sought information about the new "synthetic" music. "I am very curious," she wrote, "to know and understand the principle of this machine."<sup>75</sup> Florence Perrella, who studied the RCA synthesizer for her undergraduate thesis in 1956, wrote to Olson that "electronic research has brought unimagined resources to music." She pressed him to reconsider the machine's purpose: "Since any conceivable sound can be dialed in, how come the synthesizer is used to imitate existing instruments? I had hoped to hear new sounds."<sup>76</sup> Another student, Sonja Carlson, requested more information about the synthesizer for a physics project: "I recently read in a Hi-Fidelity Magazine that RCA has developed an Electronic Music Synthesizer. The article stated that it has an unlimited capacity for duplicating sounds . . . and creating new sounds to order." She was interested in obtaining more details about the machine's development as well as "its place in society."<sup>77</sup> Olson responded to these letters with equanimity: he tended to send everyone—from

music historians to fellow inventors to women in high school and college—a reprint of his 1955 article, coauthored with Herbert Belar, on the synthesizer in the *Journal of the Acoustical Society of America*, sometimes with a brief personal addendum.<sup>78</sup>

Another correspondent of note in 1956 was Fannie R. Buchanan, who in 1925 became the first Iowa State Music extension specialist for the Iowa State College Cooperative Extension Service in Agriculture and Home Economics, a post she held for over two decades.<sup>79</sup> She had previously served as a rural specialist for the Victor Talking Machine Company.<sup>80</sup> Well known regionally for writing songs for 4-H youth groups and for her work in bringing varied musical knowledge to rural Iowans,<sup>81</sup> Buchanan wrote to Olson in order to finalize a chapter on the RCA synthesizer for the latest edition of her children's book *How Man Made Music*; they corresponded to confirm the accuracy of its technical details.<sup>82</sup> Buchanan died in 1957, at the age of eighty-two.<sup>83</sup> While the bulk of letters from women to Olson were written by young women in high school and college, this correspondence signals the reach of the RCA synthesizer to women of all ages, including elders such as Buchanan and the grade-school audience for her book. Buchanan and her readership were also far removed from the urban locales of experimental electronic music, such as the Columbia-Princeton studios and its network of affinity academic and broadcast studios around the world, where historians have previously located the RCA synthesizer's sphere of influence.

At the same time that these letters from women around the country were arriving, Olson recommended to RCA's marketers that they place advertisements for the synthesizer and its recordings in hi-fi audio and electronics engineering magazines, which was perhaps a move to direct the emerging market for synthesizers toward men who were presumed to be technical experts and hobbyists.<sup>84</sup> For Olson, this would likely have been an unreflexive expression of the homosocial engineering cultures and gendered divisions of labor in the labs and offices of which he was a part. While women expressed burgeoning knowledge of electronics in their letters to Olson, they were not, or were rarely, among the audio engineers he would have encountered in the RCA laboratories and in professional societies. One example of the place of women in Olson's lab, a typed document from 1955 included with the papers of Olson's associate Roland Lynn, details the equipment and personnel necessary for installing the RCA synthesizer at a new studio: the one "female operator" responsible for administrative duties was crossed out by hand, while men who worked in supervisory or technical roles were retained.<sup>85</sup>



FIGURE 2. Telephone operators, Seattle, Washington, 1952.  
(Courtesy Creative Commons.)

Women's and girls' participation in some areas of American popular music in the 1950s and '60s—for example, their roles as music fans and girl-group vocalists—has been well documented.<sup>86</sup> But their interest in the RCA synthesizer is part of another, less well-elaborated historical trajectory: that of women and girls interested in audio technologies, electronics tinkering, and music production.<sup>87</sup> Indeed, women could have been a logical market for synthesizers beginning in the 1950s, in that the technology and associated techniques of the synthesizer patch, the configuration of wires that assemble component elements of a sound into one signal, was inherited from telephone operating—a profession thoroughly associated with women as a labor force and in popular culture (fig. 2). As John Durham Peters writes: “The female body hidden at the heart of a national communications network . . . is an archetypal figure. In popular culture the [telephone] operator was often treated as a heroine who, knowing



everyone's habits, could bring people together in emergencies: the operator as matchmaker, lifeguard, or angel of mercy."<sup>88</sup>

Caroline Martel's compelling documentary *The Phantom of the Operator/Le fantôme de l'opératrice* (2004) showcases telephone operating as a virtuosic performance of technical skill. Her film posits that the telephone operator was like a "test pilot of the networked world that fell into its void": she was paradoxically ubiquitous in popular culture but invisible behind a vast network, and she pioneered widespread telephonic connectivity only to be rendered obsolete and out of work as soon as automated systems became available.<sup>89</sup>

In summary, despite the presence of women in analog technocultures, synthesizer histories tend to locate innovations in electronic music and musical instrument development as originating from male homosocial audio engineering and electronics tinkering cultures.<sup>90</sup> There are indeed precedents for this gendered form of media historiography. During the early decades of the twentieth century, as Michele Hilmes has shown, women were active amateur radio enthusiasts, although historical accounts tend to account only for men as inventors and hobbyists, or for women as an audience for radio, while eliding the role of women as technical enthusiasts and producers.<sup>91</sup> In the early-twentieth-century United States, women also played a key role in the evolution of the phonograph; Lisa Gitelman has documented how the predominant use of the phonograph for home entertainment was a significant departure from the expectations of Thomas Edison and others who had envisioned its primary function to be a recording device for business dictation. The transformation of its use to playback has been commonly attributed to Edison's "accidental genius" or portrayed as a triumph in industrial design or as a victory for the culture industry. In fact, the changing social roles and practices of middle-class American women, including music-making in domestic space and shopping as a leisure activity, helped to create a fertile cultural context for recorded sound to become intelligible as a form of home entertainment.<sup>92</sup> Likewise, the letters from women to Olson on the RCA synthesizer, as well as the technical continuities between telephone operating and analog synthesis methods, suggest that women's work, technical aptitude, and interests helped to enable the broad-based market for analog synthesizers that greeted Moog and others in the 1960s once these instruments had become affordable and portable enough for widespread use.

#### EPILOGUE: FINDING DORIS

I began my research on the history of synthesized sound after I had completed the *Pink Noises* project, a collection of interviews with women who are DJs,

electronic musicians, and sound artists. For *Pink Noises*, I did ethnographic research within a community of musicians and soundmakers of which I am a part; after negotiating the complex ethics and politics of interviewing friends, mentors, and colleagues, I was eager to get back inside the archives and to study historical figures and artifacts. I was also ready to shift away from an identity-based feminist historiographic intervention that centered on the category of “women.” While I have argued that a book of interviews with women in electronic music remains a meaningful intervention, given the ways that this social category functions historically and currently as a powerful mode of exclusion, I also considered that work to be part of a larger and ongoing research project of problematizing gender in electronic music cultures.

So, with my research on synthesis, I set out to examine how social differences inhabit audio-technical discourse and how gendered and racialized metaphors in particular become materialized in sonic forms and technologies. Like the young women interested in the RCA synthesizer, I wanted to know and understand the principles of these machines and to assess their social and cultural implications. Imagine my surprise, then, when I was surrounded by file folders of documents on component parts and other technical details at the RCA archives and when the letters from young women to Harry Olson appeared among them. Their appearance was yet another example of how women have always been present as active participants in audio-technical cultures despite their routine omission from historical accounts—and still the letters, seemingly out of place as they interrupted an archive devoted to Olson’s achievements, caught me by surprise.

It was a few more years before I pursued the possibility of locating the women who had written these letters and inquiring about their experiences and recollections, thus revisiting informal ethnography as part of this ongoing historiographic inquiry. In 2014, I was able to connect with Doris Dailey, now in her seventies. After an introduction via email, we maintained a brief correspondence by regular mail, and she provided answers to some of my questions about her memories of RCA synthesizers and her interest in electronic music. I shared with her a copy of *Pink Noises*, which she read and responded to via email. Dailey conveyed that her keen interest in synthesizers and electronic music had lacked fertile cultural ground to sustain it. As a teenager, she had avidly responded to the electronic soundtrack of *Forbidden Planet*, tracked down a *Popular Electronics* plan for building a theremin (fig. 3), and sought out details on the RCA machine. But she also reported that she was denied access to the science and engineering classes, teachers, and equipment that she had sought in formal educational settings in

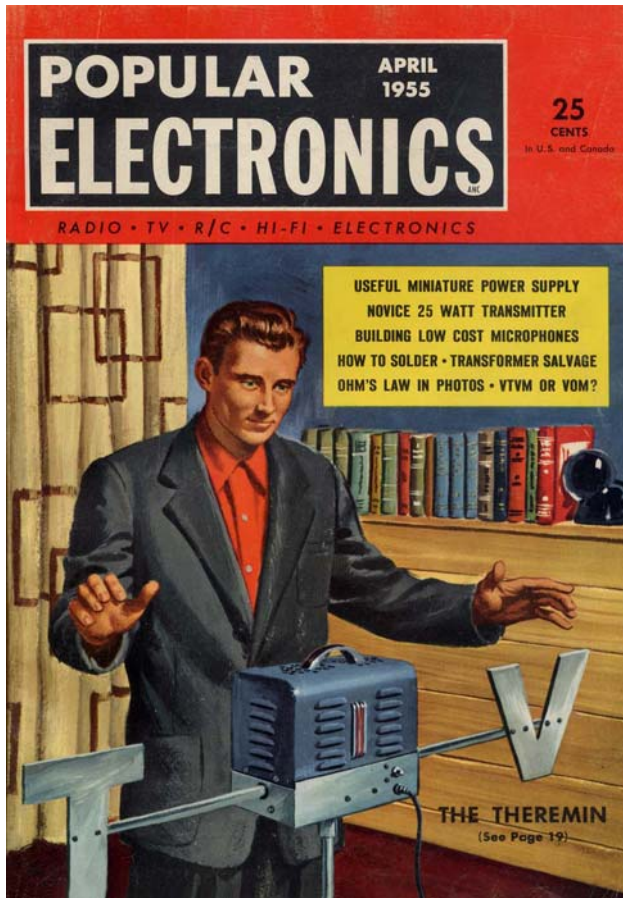


FIGURE 3. *Popular Electronics* cover, April 1955. (Courtesy Michael Holley's Southwest Technical Products Corporation Documentation Collection.)

high school and college; that she once was steered toward a cooking class instead; and that she was not allowed to use an oscilloscope for a demonstration in which she had planned to show classmates how Olson's machine produced variations in attack, duration, and decay of tones. After her schooling, time for pursuing hobbies was offset by marriage and childcare commitments. Later in life, through jobs and volunteer activities as a teacher, museum educator, and learning-center designer, she persisted in finding outlets for her interests in both science and electronic music and found reward in sharing her knowledge and enthusiasm with others—"especially girls."<sup>93</sup>

Consider Dailey's path from the mid-1950s onward in relation to that of her peer Robert Moog, who was just a few years her senior. Moog, too, had written letters to Olson and other inventors expressing interest in early synthesizers and requesting technical information, and of course he built his own theremin. Technological curiosity can be a generative starting point for all sorts of things—from creative expression, to informal tinkering, to building confidence in one's ability to conceive and complete any project, to a career path, to becoming a technological innovator and even the historical subject of a so-called revolution in sound. The letters from Dailey and other young women to Harry Olson mark such generative beginnings in their own lives, though Dailey's experiences point out the limited possibilities that young women faced for carrying audio-technical interests forward in formal educational settings or as sustainable professional paths. To be sure, gender was and remains a factor in whether technological enthusiasm and curiosity are encouraged and supported. In the 1950s and '60s, while some men enjoyed the "freedom" to tinker outside their formal engineering jobs, women were more likely to be discouraged from acquiring technical knowledge and pursuing those careers at the outset. However problematic the coinage of the "patchbay-nun" figure may be, a certain sense of isolation felt in this era by women who were interested in audio and engineering cultures was likely very real. Yet one also begins to sense a distributed community of practitioners taking shape, not unlike the women electronic music producers who are now able to stay connected through online networks such as female:pressure. The letters from young women to RCA are an important reminder that, despite the relatively few extant photographs and recordings documenting work by women composers and electronic music innovators of decades past, many more women and girls may well have been poring over popular hi-fi and electronics magazines, imagining their own technological revolutions in sound, and helping, by their enthusiasm and amateur projects, to lay the groundwork for widespread acceptance of analog synthesizers as the beloved, mass-marketable musical instruments that are still taking the world by storm today. ■

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## NOTES

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74. Doris J. Dailey, letters to Harry F. Olson, ca. January 1956 and April 21, 1956, both Olson Collection.
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