Moog, in 1975, perhaps chastened by his own experiences in the commercial world, came to appreciate Buchla's anticommercial stance: "I have to admire what Don Buchla has done. He hasn't allowed himself to limit the complexity of his instruments to meet the demands of the so-called marketplace. It has been the conventional wisdom for some time that a complicated piece of electronic music equipment can't be sold off the music store floor. Buchla has chosen not to worry about this."[2]

Buchla has garnered the reputation of being the odd ball in the synthesizer field. What counts as odd, of course, depends on what is going to count as normal. Back in 1965 it was not at all clear that the synthesizer would appeal to a mass market, and also it was not clear that it would become primarily a keyboard instrument. To understand how all this occurred, we return to Trumansburg, to see what Bob Moog was up to.

3

Shaping the Synthesizer

The Moog filter design is as unique to the sounds of the synthesizer as the Steinway steel frame is to the piano.
HERB DEUTSCH

BOB MOOG WAS excited. He may have been only a graduate student, but he had made a start in the electronic music instrument business. He had built his first synthesizer modules, he had three precious orders, and he had his beloved shop. And the shop was soon going to expand.

The Modular Moog synthesizer, which was advertised for the first time as a "synthesizer" in 1966, emerged over a period of time from a thousand different design decisions and a thousand conversations. It was an *innovation* rather than an invention.

The history of technology tells us that inventions are two a penny. There are many, many people who invent new things: machines, processes, tools, gizmos, gadgets, widgets, and the like. Such people are often portrayed as unsung heroes, ahead of their field, unrecognized in their own time. But singing in the bath is not the same as singing on stage. There are very few people who successfully turn their inventions into a real product that can be manufactured, marketed, and sold. The field of electronic music instruments is littered with inventions, but there have been very few true innovations.

One of the most spectacular inventions is Thaddeus Cahill's Telhar-

monium, developed in 1901.[1] This enormous instrument, which weighed 200 tons, generated sound from giant alternators. It was installed in Telharmonium Hall in downtown Manhattan, and its sound was piped to nearby hotels and restaurants. Technical problems of crosstalk with the ordinary telephone cables and a rather annoying timbre led to its failure. It was, however, a precursor to one of the few true musical innovations—the immensely popular Hammond organ invented by Laurens Hammond in 1933.[2] Hammond used a series of spinning tone wheels (a miniaturized form of the Telharmonium sound source) and took advantage of tube amplifiers and loud speakers (unavailable to Cahill).

Another notable inventor was Friedrich Trautwein, who in 1928 developed the trautonium (which Goebbels was keen to use for Nazi propaganda) and who, with composer Oskar Sala, went on to produce the mixturtrautonium used for the sound effects in Hitchcock's *The Birds* (1963).[3] Maurice Martentot developed the Ondes Martenot in 1928; it was used in classical performance and had a special repertoire written for it, including works by Varese, Messiaen, Boulez, and Ravel. To this day it is still used in France. Luigi Russolo, a member of the Italian futurists, in 1914 developed an early mechanical form of the synthesizer. His *intonarumori* (noise instruments) provoked scandal but remained as oddities.[4] However, like the theremin and the Ondes Martenot, Russolo's *intonarumori* found a home in movies.

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The Listening Strategy

Bob's success as an innovator can be traced to one key factor: he listened to what his customers wanted and responded to their needs. Rather than telling them "this is the way things are going to be," he devised a strategy over the years for learning how other people wanted things to be. He learned from going on the road, entering their homes and studios, and bringing them to Trumansburg, first for a summer workshop and later to his own factory studio. He saw more clearly than anyone that his own fate as a manufacturer was tied to the success of the field as a whole, and he devised ways of nurturing that field, such as by starting his own magazine for electronic music.

Moog's strategy does not appear to have been deliberate. It was not that on the bus ride home from the 1964 Audio Engineering Society meeting Bob planned out the next three years. As he constantly reminded us, "I didn't know what the hell I was doing." He fell into what he was doing, but he learned as he fell. He learned from what he found happening to him, around him, and in the culture. And above all it was fun. Bob had a blast during those early years. What he enjoyed doing most we know already—fiddling, diddling, and futzing with electronics. But he soon discovered he enjoyed something else—meeting his customers, many of whom became his life-long friends. Moog: "Nikolais and Siday and Hillar and all the people I did business with in the early days have remained collaborators and friends and customers throughout the years. I've gotten to know them all . . . They've been very valuable to me both as personal friendships and as guidance in refining synthesizer components."

That guidance began with his first three customers. Alwin Nikolais, Lejaren Hillar, and Eric Siday represented a spectrum of needs. Nikolais wanted a bunch of modules on which to make avant-garde music for the dance troupe he choreographed. He had previously used tape loops. Hillar was an academic composer who headed the well-known University of Illinois electronic music studio, and Siday was a commercial musician. Moog formed a particularly close relationship with Siday, whose order turned out to be important for the future of the synthesizer. Siday wanted not just modules but a complete system, and he had the money to pay for it.

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Eric Siday

Eric Siday was one of the best-paid commercial musicians of the day. Trained as a violinist at the London Royal Academy of Music in the 1920s, he played in silent films before moving to the United States in 1938. When

radio and TV came along, he helped invent a new occupation: creating electronic jingles, sound signatures, and sound logos that, in five seconds, identify a product or corporation on TV or radio. He used oscillators, tape loops, splicing, and any other technique he could lay his hands on to ply his new trade. One of his best-known signatures was the burps of coffee percolating in a Maxwell House coffee commercial. The little electronic ditty that introduced every CBS television show as an announcer said "CBS presents this Program in Color" was heard by millions, and it earned him $5,000 for each second of sound.[3]

After Moog's AES presentation, Siday and his technician came to Trumansburg. Moog: "We sat down and conceived on paper a whole modular system that was going to cost him $1,400. It was an incredible load of stuff . . . something like ten or twelve modules." As far as Bob can recall, "this is the first time when a system the size of a synthesizer was actually talked about between me and a central customer." Bob had already designed many of the modules Siday wanted. He had voltage-controlled oscillators, amplifiers, and filters, and he had envelope generators. But now he had to put them all together into one system. He had to design a workable keyboard and a cabinet in which to house everything. He also had to come up with a price. "I knew about what the material would cost. I thought I had an idea of how much work would go into it, once we knew how to build them. Well, I didn't know! A lot of time it was just feeling and guesswork. I was not a businessman at the time . . . I literally didn't know what a balance sheet was." The business side of things was something Moog never enjoyed or mastered. "Feeling and guesswork," as he was to discover the hard way, didn't keep a business running.

After six months' work the system was ready for delivery. Siday's studio was in his home, a grand ten-room apartment in an Upper West Side building, the Apthorp. Siday had taken over the elegant living room and maid's bedroom for his work. "It was completely filled up with instruments and half-instruments and stuff taken apart and stands and whatnot." It was to this home studio that Bob was to deliver his first complete system. There

was just one problem: How was he going to get this rather large synthesizer down to New York?

Bob did what he always did—he rode the bus: "We worked months and months and we sweated it out. First product, and we were very proud of it. My coworkers and I packed it up into some cardboard cartons and I took it on a bus—a big synthesizer—it takes two men to carry each box . . . I got it into a taxi after the bus and got it to the Apthorp." It was now morning and Bob was a "little bit strung out" after his night on the bus:

> It's eight o'clock in the morning and Edith [Eric's wife] is watching this like a shy child . . . from one of the doorways. I put one of the boxes down and take the lid off and take all the packing out and spread it on the hall floor. Take one of the instruments out and set it up. Begin to unpack the next box and I didn't realize this, but Edith is slowly losing control of herself. She's watching this. I was busy unpacking. I'm setting the second box up . . . All of a sudden she loses control of herself completely. She screams out, 'Eric, more shit in this house. All you ever do is bring shit in this house. One piece of shit after the other!' . . . and somehow I got the instrument set up and [got] out of there that day.

Over the years Moog designed many customized modules for Siday, including a keyboard where each note was individually tunable, although he had trouble delivering them on schedule. On another famous occasion, Edith (who by now had become close with Shirleigh Moog) bawled Bob out for keeping Eric waiting for a piece of equipment. Bob found it hard to make a deadline—he was nearly always late.

Other customers were important for the future of the synthesizer, and none more so than Wendy (formerly Walter) Carlos, who pushed Bob to perfect the technology. It was at her urging that Bob designed his first touch-sensitive keyboard. She also came up with the idea of adding the portamento control and the fixed filter bank (a form of graphic equalizer), which eventually became standard features. The portamento control,

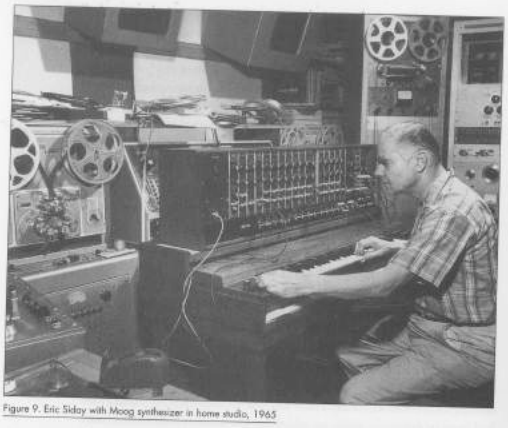

Figure 9. Eric Siday with Moog synthesizer in home studio, 1965

which allows the voltage generated by one key to slide smoothly to the next, was particularly important for live performance. It was rock performer Keith Emerson's favorite feature of the Moog.

To Key or Not to Key?

Listening to what customers wanted was all very well, but what if customers disagreed over what they wanted? Moog soon faced this problem. In 1965 Vladimir Ussachevsky contacted Moog and expressed interest in buying some of his modules, but in the end he bought very few. Instead, he bought three complete systems from Don Buchla, which, unlike Moog's synthesizers, had no keyboard. Ussachevsky was well-known for opposing the keyboard. The standard keyboard just did not fit with his conception of how electronic music should be made. And Ussachevsky was not someone Bob could easily ignore. Ussachevsky had started off as an engineer and switched to music later. He spoke the language of engineering, and the way to Bob's heart was, of course, through circuitry.

Soon Ussachevsky and Bob were discussing one specific circuit—the envelope generator. Normally such a module is used with a keyboard as a trigger to make the sound of, say, a plucked string. Ussachevsky wanted an envelope generator, but he didn't want it to be triggered by a keyboard. Instead, he planned to use it with tapes to shape recorded sounds. Moog designed him a special module with the envelope triggered by an external switch rather than by a keyboard.

Moog's interaction with Ussachevsky was important not only because it conveyed to him the depth of hostility toward the keyboard that existed among some serious composers but also because it led to the standard way to describe the main functions of an envelope generator in terms of T_i (attack time), T_s (initial decay time), E_{SUS} (sustain level), and T_f (final decay time). Eventually ARP simplified this to the ADSR (attack, decay, sustain, and release) nomenclature still in current usage.

That Ussachevsky had purchased his rival's synthesizers and was opposed to the keyboard gave Moog food for thought. Moog was not strongly wedded to the keyboard as a controller; it was just one option. After all, he built theremins, and these were about as far removed as you could get from a keyboard-controlled instrument. But not everyone agreed with Ussachevsky. One composer who saw things rather differently was Herb Deutsch, who had been Moog's first collaborator: "Bob didn't want to have a keyboard, because he had talked to Vladimir Ussachevsky, and Vladimir

said, 'Oh, no, you don't want a keyboard, because then people are going to think of it more traditionally. You'll be, it'll be dominated by the need to be tonal, or at least relate to tonal design' . . . And I simply thought, Well, it didn't bother Schoenberg to have a keyboard. I mean, he still created atonal music and you still have the freedom to do anything you want. And I persuaded Bob to do a keyboard on it." Deutsch felt, in other words, that a serious composer would be able to overcome any conventional associations the keyboard evoked.

The commercial appeal of the keyboard was something Deutsch and Moog both recognized as well. Walter Sear also put pressure on Moog to stick with the keyboard: "Buchla's [synthesizer] had nothing to do with musicians. I kept saying without a keyboard it's not anything that a musician [could use], you know, all musicians, in those days, had to have some background in keyboard." And commercial musicians were voting with their feet—or rather their hands. Eric Siday had wanted keyboards. So too did other commercial musicians.

For many musicians, the simpler-to-operate Moog with its keyboard interface was more appealing. Moog, no doubt impressed by what most of his customers wanted, decided to stay with the keyboard, himself regarding it as a "general controller" with which to adjust a variety of modules on the synthesizer and not simply as a way to play melodic music.

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Keyboard Culture

As the Moog synthesizer evolved, it increasingly became seen as a keyboard instrument. Many of the photographs of the Moog (in the media, on record albums, and in promotional literature) show the keyboards prominently displayed. In these early pictures the right hand of the operator is usually on the keyboard while the left hand is outstretched adjusting the knobs. We asked Bob about these pictures: "The keyboards were always there, and whenever someone wanted to take a picture, for some reason or other it looks good if you're playing a keyboard. People understand that then you're

making music. You know [without it] you could be tuning in Russia! This pose here [acts out the pose of the left arm extended] graphically ties in the music and the technology. So there are probably a zillion pictures like that."

The need to show that "you're making music" was something of which Bob was all too well aware. The modular Moog synthesizer is a very odd musical instrument, because, unlike most instruments, you cannot immediately get a sound out of it. It first has to be plugged in, patched up, and connected to an amplifier and loudspeaker. On first encountering the synthesizer, people often expect to hear a tune. Jon Weiss discovered this when he brought the synthesizer on the set for Mick Jagger's use in the movie *Performance*: "I had to go through this with the English workers, saying 'Agh it's a fabulous sanitizer and what does it do?' You know, 'Play us a tune' . . . Moog heard that so much that in one series of synthesizers he put a little speaker and amplifier in one so that you could actually hear something. People couldn't conceive that this is an instrument but it doesn't do anything."

A keyboard is immediately recognizable; it's an icon and "looks good" and invites people to come and play it. And it is here that the wider culture and particularly the dominance of the piano played a role in shaping the synthesizer. Over time, almost inexorably, the Moog synthesizer became a keyboard synthesizer. By the time the Minimoog was developed in 1970, it was, de facto, a keyboard instrument.

Moog has eventually come to see the wisdom of not following the strict approach of Ussachevsky and Milton Babbitt, another giant of electronic music composition who co-directed the Columbia-Princeton studio in Princeton and was closely associated with composing on the RCA synthesizer. Moog: "Ussachevsky and Babbitt have always talked as if they were the light and the way and everyone else should follow them. But actually their concept is very narrow, I think. They have dictated that certain things shall not be. There shall not be keyboards and that sort of thing."

With hindsight, we can see that Bob's decision to design his system

around a keyboard was a propitious one. But again, hindsight should not mislead. At the time, this was just one of many little decisions being made. It was not that Moog looked into his crystal ball and foresaw that the synthesizer would become a keyboard instrument. It was just that if musicians wanted keyboards, who was he to stop them having what they wanted? His strategy of listening and responding to customers meant that the synthesizer as a keyboard instrument was being shaped by the wider culture. And that culture would, in turn, be shaped and changed by the Moog.

○

The Ribbon Controller

Although Moog went down the keyboard path, he also developed other sorts of interfaces such as the ribbon controller (also known as the linear controller or stringer).[6] This two-foot-long narrow rectangular box has a taut gold-plated metal band strung over a resistance strip running along its length. By moving a finger along the band and pushing down the musician can vary the control voltage smoothly in direct proportion to the point of contact. The ribbon can be used to control the pitch of an oscillator in a similar way to moving a finger up and down a violin string. It can also be used for vibrato, or to control other modules like the filter.

Musicians came to value the ribbon, especially in live performance. One such musician was Chris Swansen, a Trumansburg-based jazz musician. By rapidly sliding his finger backward and forward along the controller, Swansen produced the same effect as a trombonist sliding the arm of his trombone in and out. Swansen played the ribbon with one hand while he played keyboards with the other. It was also useful in the studio. Malcolm Cecil and Bob Margouleff used the ribbon controller with Stevie Wonder to produce the classic "burump" of the bass on "Boogie on, Reggae Woman," and Paul McCartney used it on the Beatles track "Maxwell's Silver Hammer."

Rock keyboardists took to the controller with a vengeance for live performance. For Keith Emerson, it was an indispensable part of his stage act.

The shape of the ribbon controller evokes the guitar, and Keith Emerson wielded it like an axe. Videos of Emerson, Lake and Palmer in performance show Keith standing on stage in all the pomp rock regalia of the day lifting his ribbon controller upward from his groin as the music swells and climaxes. Keith even had toy rocket motors attached to the ribbon controller to fire up at such moments for added pyrotechnic effect (once in rehearsal he was demonstrating the rockets to a fire marshal and was lucky to have had only his thumbnail blown off).

But in the middle of all these pyrotechnics Keith stumbled upon a new use for his ribbon controller: "The ribbon got so worn down, and I was almost complaining, 'Oh God, I've worn this out. I should really call Bob up and get a new ribbon.' But then I realized that by short-circuiting my thumb across the ribbon and the actual bar it made these machine-gun sounds. I thought, 'No, this is great!' There again, it was just, the instrument wore out, but I got other sounds out of it as a consequence." Even in the Moog's imperfections musicians could often find a use.

Running around with a big electronic phallus in live performance is not always easy. Keith's ribbon controller usually had a hundred feet of cable, but on one occasion he was limited to twenty-five feet and he forgot how far he could go. Will Alexander, Keith's keyboard technician, recalls what happened next: "During the Japan tour, the band was playing in Osaka at a baseball stadium. They were set up in the outfield and the audience was 150 feet away, up where the home plate was. So Keith started playing with the ribbon controller and he went running at the audience, when all of a sudden he reached the end and it knocked him down. It made the Moog go berserk."[7] Keith, always the consummate showman, was able to deal with the incident with aplomb: "He got up, turned and bowed to the audience, and went running back to the stage."[8] By, in effect, turning the ribbon controller into a guitar, Emerson and his audience (mainly made up of young men) were reproducing all the cultural and gender symbolism that the guitar as "technophallus" in rock music evokes.[9]

Music seems to be one of the most conservative areas of cultural produc-

Figure 10. Keith Emerson with ribbon controller, 1980

tion. Here was a new instrument, the synthesizer, one of the few new instruments ever to come along, and people seemed obliged to perceive it in terms of instruments with which they were familiar, the piano and guitar. Escape from these shadows would be difficult.

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The Moog Ladder Filter

Moog's voltage-controlled oscillators, amplifiers, filters, and envelope generators were initially based on standard circuits. Sometime during late 1965 and early 1966 Moog came up with a novel design for a filter, known as the low-pass filter or ladder filter (after the ladder of transistors in the circuit). This filter is the crown jewel of the Moog synthesizer—it is the "rich," "fat," "juicy" tone that nearly everyone refers to as the Moog sound. This is the

filter that Moog's rivals at ARP and EMS were most envious of and which they tried to copy.

Filters, which control the higher harmonics of sound, were not new; they had been used since the days of radio. Bob seems to have designed his unique low-pass filter from a combination of book knowledge and his usual tinkering. He presented the design in a paper delivered to the AES convention on October 11, 1965. A year later, on October 10, 1966, he filed for a patent, which was granted on October 28, 1969. It is the only item on the whole synthesizer that Moog ever patented.[10]

A low-pass filter can be thought of as a gate in a stream. The higher it is raised, the higher the harmonic frequencies that pass through it—or, more correctly, under it, since it's a low-pass filter. If you speak into a long pipe, your voice will be muffled because the pipe is acting as a low-pass filter; talking into a pillow has the same effect. Where the cutoff occurs—that is, how high the gate is raised—depends on where the cutoff control is set. By varying the height of the gate, the timbre or tone color of the sound can be varied. (Timbre is what allows you to distinguish a pitch played by a clarinet from the same pitch played by an oboe.) By voltage-controlling the gate, the musician can sweep the filter through its range, changing the timbre of the sound by emphasizing some harmonics and attenuating others.

Bob found a novel circuit to do this, using pairs of transistors connected by capacitors arranged in a ladder. This makes the filter balanced, because the signals can go up both sides of the ladder at the same time. The signals enter the bottom of the ladder, and those with higher frequencies find it hard to make their way up the ladder because of the electrical properties of the transistors and capacitors.[11] One of the main factors in the quality of the sound from the Moog filter is a characteristic called the cutoff slope. A filter doesn't actually chop the high harmonics off completely but rather attenuates them. The cutoff slope refers to how abruptly the amplitudes of the high frequencies taper off. The Moog filter has a much sharper cutoff slope than almost any other synthesizer filter.[12]

The filter has many other qualities, such as a sharp resonance around the

cut-off frequency. When the filter is overdriven—which means that the amplitudes of the signals going into the filter are too large—it produces a rich form of distortion that is characteristic of the fat Moog sound. Jim Scott, a Moog engineer who worked extensively with the ladder filter, adapting it for use on the Minimoog, commented, "This filter defies analysis. There are lots of subtle things going on that almost defy mathematical treatment."[13] The best analog components in sound nearly always have this quality of not being quite understood and nearly always involve some not quite specifiable resonances and distortions that occur at high frequencies beyond the audible range but that produce audible effects.

When the filter is used with an envelope generator in the bass range, the resonant deep sound is particularly appealing and was soon discovered by synthesists.[14] Over the years it has become a staple of pop and rock music, as has the bass sound of the Minimoog (which uses a similar filter). Bob Moog was himself a witness to the power of his bass sound when he was invited to bring his synthesizer to a New York studio session where Simon and Garfunkel were recording their album *Bookends* (1968). Moog set up the bass sound himself for the track "Save the Life of a Child," which opens with this sound: "One sound I remember distinctly was a plucked string, like a bass sound. Then it would slide down—it was something you could not do on an acoustic bass or an electric bass . . . a couple of session musicians came through. One guy was carrying a bass and he stops and he listens, and listens. He turned white as a sheet." The significance of the Moog bass sound was not lost on this session musician. The Moog not only sounded like an acoustic or electric bass, but it also sounded *better*.

Moog liked to repeat this story; he felt that at last he was "getting somewhere." At last the Moog was finding a home among musicians at large, rather than being an instrument merely for the avant-garde. Session musicians were some of the first to see the writing on the wall; their livelihoods were under threat. This threat was something that the powerful musicians' union would eventually take up.

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But Is It a Synthesizer?

In the early accounts of his work, Moog refers to "electronic music modules" and a "system" of such modules, but he does not use the word "synthesizer." In 1966 he used the term "synthesizer" for the first time in print, and in 1967 he introduced the "Synthesizer Concept."[15] The classical meaning of "to synthesize" is to assemble a whole out of parts. A synthesizer assembled parts of a sound into a complete sound. Moog, like Buchla, thought long and hard about whether to use the term. The name was associated with the RCA synthesizer, but Moog's synthesizer, unlike the RCA, worked in real time and had a keyboard. Moog and Deutsch debated this a lot. Reynold Weidenaar, a composer based at the Moog factory, joined the debate: "I remember when he told me that was his decision, to call it a synthesizer . . . I said, 'You can't do that, you know, the RCA device is the synthesizer, and everybody's going to think of the RCA synthesizer if you use this word, so you're going to have to think of another word.' And he said, 'Well, no, it's a synthesizer and that's what it does and we're just going to have to go with it.' And so he was obstinate, and good thing, too."

By the time other manufacturers like ARP and EMS got going in the late sixties and early seventies, "synthesizer" had become the standard name. Buchla held out longest against the usage, but even he at some point recognized that this was the name that most people were using.

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What's in the Moog Name

For a short while in the late 1960s and early 1970s, the Moog became the brand name for any synthesizer, in much the same way that the Hoover was synonymous with vacuum cleaners.[16] Branding—making customers aware of your brand, above all of its competitors—can be crucial for the success of a product, as marketers are well aware.

Moog is a Dutch name and rhymes with "rogue," not "fugue." Many people, including musicians, continue to this day to mispronounce the name. Bob even used to have a placard on his desk telling people how to pronounce his name. Several people unfamiliar with the existence of the real Bob Moog have told us that they assumed the name was made up to resemble the sound of the synthesizer itself—MOOOOOOOOOOG! Cows moo, but synthesizers moog, and as David Van Koevering (the best Moog salesman ever) once said, paraphrasing the sixties lyric by Jonathan King: "Everyone's gone to the Moog [Moon]." The name not only sounds right, it also looks right in distinctive letters adorning a piece of equipment.

And here Moog was extremely lucky. If his name had been Larry Smith or Dusan Bjelic, it is unlikely that his make of synthesizer would have become the brand name.[17] Naming a synthesizer is no trivial matter, as the Japanese, who would later dominate the market, were well aware. Ikutaro Kakehashi, the founder of Roland, the most successful synthesizer company in the world today, told us that he came up with the name by looking through an American telephone directory. Having found the name, he wrote it on piece of paper and attached it to an organ (in those days the company made organs) for a week to see if it felt right. It did![18]

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The 900 Series

By October 1965 Moog had standardized the different modules, which became known as the 900 series.[19] The modules varied in price from $195 for a 901 VCO to $475 for a 904 filter. In April 1967 Moog introduced for the first time a catalog with complete "synthesizers."[20] He offered three different models (I, II, and III) ranging in price from $2,800 to $6,200. The most expensive model cost a sizable chunk of money—enough to buy a small house. A more elaborate system with a tape recorder and amplifier could set you back a lot more. Even rock stars were known to balk at the cost. Keith Emerson tried hard to get his for free, and Mick Jagger, on being told the price, famously remarked, "Man, that's a lot of bread."

The first Moog catalog listed numerous customers who had bought Moog equipment, and on the inside back and front covers were endorsements from 21 composers and directors of studios, including Siday, Carlos, Ciamanga, Deutsch, and Nikolais. This impressive list shows that Moog was reaping the benefit of his close links with his customers if for no other purpose than to promote his equipment. The catalog was directed almost exclusively at the electronic music composers who made up the bulk of Moog's customers. "Moog synthesizers are designed to meet the requirements of composers of all types of electronic music."[21] These requirements were "based on discussions with over 100 composers." The first requirement was that "the synthesizer should perform all of the basic generating and modifying operations of the classical studio, and provide additional resources with the state of the art."

Moog had the name, and by 1967 he had the product. Also, the culture around him was slowly changing, becoming ever more receptive to his innovation. We now turn to look at how this culture was experienced in one funky factory, and how Moog set out to change it.