

## History of synthesisers by Craig Logue

The idea of keyboard instruments that created acoustic sounds from the physical act of a string being “hammered” or plucked is an age old idea. However this method restricted the user to the tones and sounds created by that specific instrument. For example a piano can only give the familiar tone of a piano and a harpsichord can only give the plucked tone that we know well. Throughout history pioneers were developing ways to incorporate new technologies into acoustic instrumentation, realising the potential such instruments could have for producing interesting new sounds. As far back as 3<sup>rd</sup> century BC, inventors were exploring new ways to create multi timbral sound with the invention of the “Hydraulos” which was a long lost ancestor to the more modern pipe organ that can be seen in cathedrals around the world today. Although long before electricity came along these pioneers were able to create instruments that would use multiple frequencies to achieve a single note and were able to control the volume and the pitch of the sounds being generated. However things would become more exciting with the dawn of electricity and the ability to generate sounds using oscillators and filters and resulted in the invention of the legendary instrument the Minimoog, considered to be the first commercially successful instrument combining synthesiser modules with a controller keyboard housed in a wooden case that could be easily carried around by performers.

### What is a synthesiser?

Simply put, a synthesiser is usually an electrical instrument that combines signals of different frequencies to create unique and interesting sounds. Synthesisers use electronic signals rather than acoustic sounds and require a loud speaker in order for the generated sounds to be heard. As talented musicians began to master the synthesiser they began to realise that with the correct kind of signal going through a specific combination of oscillators and filters, they could imitate other more traditional instruments such as a flute or violin, opening new avenues of sound exploration in the recording studio. One of the Pioneers of the electronic synthesiser was Robert Moog whose latest invention the Minimoog, was first introduced to listeners in 1968 on the “Switched on Bach” recording by Wendy Carlos whose cutting edge sound at the time was responsible for film scores such as Stanley Kubricks “a clockwork orange” and the motion picture “Tron” amongst others.

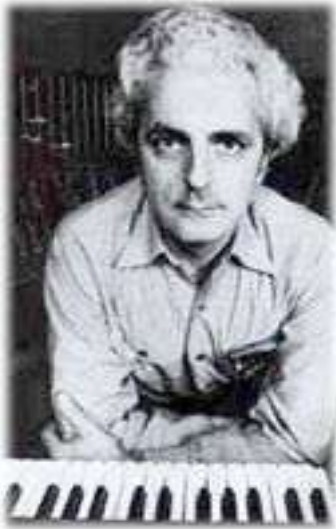


Wendy Carlos.

(Source of image <http://nottheremin.files.wordpress.com/2008/12/manning-moog.jpg>)

### Robert moog

Robert Moog was a young Physics graduate from New York City whose love affair with electronically generated sound began in 1961 when he began to build and sell Theremin kits. After two years of selling these kits, Moog knew that he had to design and manufacture his own instrument, and after toying with the idea of designing a portable guitar amplifier, he eventually settled on the idea of an electronic synthesiser. After attending an Audio Engineer Society (A E S) convention in 1963 Robert Moog became consumed with the idea of generating sound with electronic circuitry and would soon be asked to showcase his own, self designed circuits. During a stint at the Columbia Princeton Electronic Music Centre, Moog worked with musicians to develop Voltage controlled Oscillators, ADSR envelope generators, and other synthesiser modules. In 1964 Moog unveiled his first subtractive synthesiser to utilize a keyboard as a controller and after critical acclaim by his peers, and numerous design refinements, he began to manufacture the instruments for sale to the general public.



Robert Moog.

(Source of image  
[http://www.socialstereotype.com/Interviews/Entries/2004/7/1\\_ROBERT\\_MOOG\\_files/shapeimage\\_1.jpg](http://www.socialstereotype.com/Interviews/Entries/2004/7/1_ROBERT_MOOG_files/shapeimage_1.jpg))

### The mini moog

The mini moog is widely considered to be the first electronic synthesiser for musicians and not scientists. Huge custom designed moog synthesiser modules had been used in studios for some time but the mini moog was the first compact and affordable Synthesiser that could be easily carried around for live performances. The mini moog utilised three oscillator banks that could be fed multiple waveforms, all of which could be individually de tuned, allowing the player to generate interesting and unique sounds. Another huge achievement of the mini moog's design were its filters.

The mini moog had a four pole Low Pass Filter with Cut off, Resonance and ADS (attack, decay, sustain) envelopes along with keyboard tracking controls. There were also various ways to manipulate the synthesised sound using the Low Frequency Oscillator (LFO) where external audio could be processed. From the late sixties to the early seventies the mini moog evolved through four different prototype models, each new model improving on the design of the previous.

**Model A Prototype** - Built in 1969. This prototype was more like the studio based modular moog but in a much more compact form. Crudely assembled, this prototype contained six modules hard wired together and connected to a keyboard controller.

**Model-B Prototype** - Built in 1970. In this prototype, the components were brought together by a purpose built front panel lay out. The three identical VCO sections were stacked on top of each other on the left. The right side held the Amplitude and Filter contour controls and the middle section held the Noise, Filter (cut-off, res) and master tuning controls.

**Model-C Prototype** - Built in 1970. This was when the familiar left-to-right layout of Controllers, Oscillator Bank, Mixer, Modifiers and Output sections and the signature pop-up front panel had had been introduced.

**Model-D Prototype** - Built in 1970 released almost immediately after the model C prototype with just a few cosmetic tweaks before it was ready for mass production and sale to the public.

**Model-D** - Built in 1971. After a few more design tweaks and the addition of rocker switches and mod wheels, the model D prototype was eventually the product that was sold to the public.

**Model-E** – The model E was known as the Welsh Moog and was manufactured by Alex Winter's Moog Music at Caerphilly in the UK. The company formed during the 1990's to re issue the classic Moog modular parts but eventually ended up re creating their own version of the original Mini moog.

Though Robert Moog and the mini moog are still widely considered to have set the future standard for electronic synthesisers, Many rival companies such as ARP and Roland began to take Moog's ideas and develop them further and at more cost effective prices. Although seminal pieces of music in pop history have either centred around or utilised the unique sounds generated by Moog's synthesisers, Competitors and the dawn of the micro chip took the industry in a different direction and Robert Moog returned to his first love and saw out his years developing a transistorised version of the Theremin.



Model D mini moog. (Source of image <http://www.colinfraser.com/mini/mymini.jpg>)

### Its success in pop music

The warm analogue tones produced by the mini moog have made an appearance in popular music from its early years on Wendy Carlos' "Switched on Bach" through to modern day performances by dance producers The Chemical Brothers among others. When the mini moog was released its 24db/octave filter was an immediate hit with musicians and producers alike, providing a bass tone recognisable as that of the mini moog. With a certain amount of knowledge and creativity, the mini moog gave keyboard players the ability to create sounds that would give any guitarist a run for his money in a live performance. One of highlights of the mini moog's use in popular music was the album "Autobahn" by German electronic music pioneers Kraftwerk. This groundbreaking album showcased the versatility of the mini moog and is still considered to inspire music producers and bands to this day. The mini moog however proved that it was not synonymous to electronic music on Pink Floyd's 1975 song "Shine on you crazy diamond" where it showed it could just as easily sit amongst acoustic drums and big blues guitar riffs. Bands from Black Sabbath to Deep purple all purchased their mini moog's and began utilising its unique tone, but as music became software based, producers were able to recreate these sounds using virtual and software based synthesisers. However it is widely argued that the analogue warmth attained from the mini moog cannot be recreated digitally and many modern day producers are now beginning to return to this pioneering instrument.

### Components

Keyboard – This is where the user inputs the notes to be played. The keyboard is where the note's pitch and velocity information is sent to the oscillators.

Pitch Bend Wheel – This allowed the user to manipulate the pitch of the tone being sent to the mixer. The user can Bend the pitch of the note either up or down creating various effects.

Oscillators - These three components are the basic tone generators that can produce either a Saw tooth, Square or Triangle wave. The user can alter the pitch and width of the signal being generated before it reaches the filter and is manipulated.

Mixer – This is where the combined sound generated from the three Oscillators and the noise generator is sent to the filter and the audio output device. This device can take multiple input signals and output them as a single mono signal.

Modulation Wheel – This allows the user to manipulate the sound being generated by the oscillators and sent from the mixer before it reaches the filters.

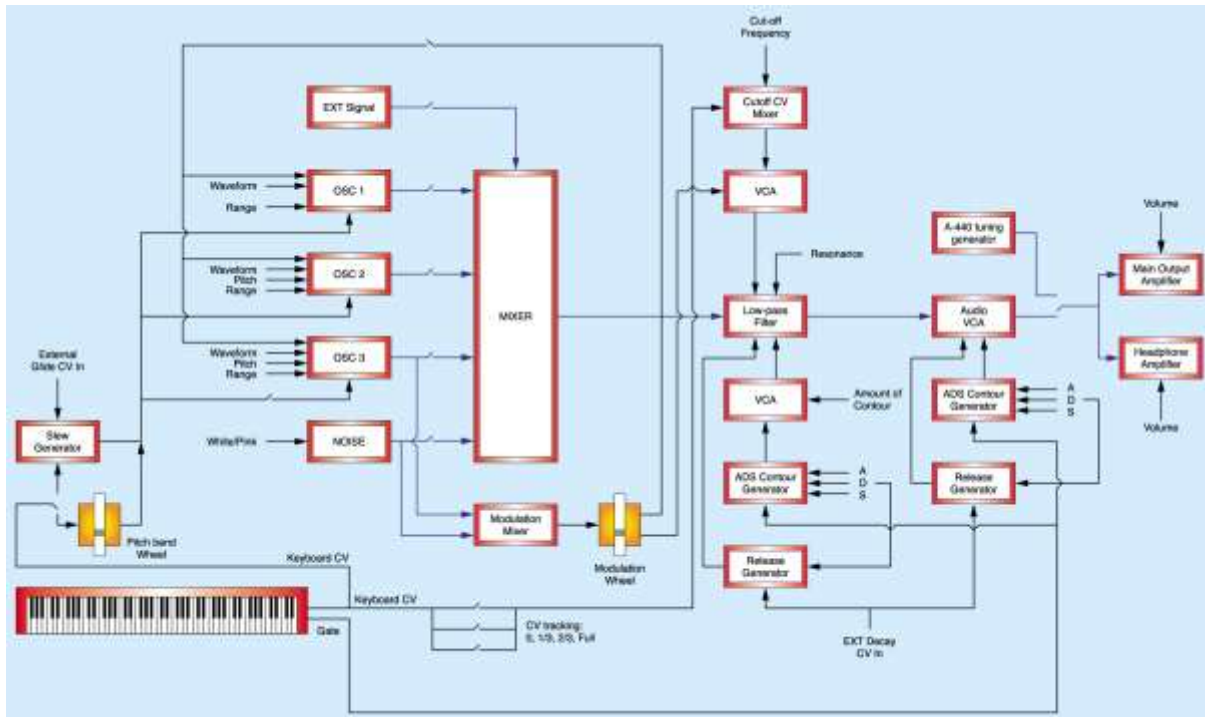
Filters – Various Cut off filters and contour generators allowed the user to further manipulate the sound being generated. It is at this stage that the user can affect the amount of Attack, Decay and sustain is applied; release is applied from a separate contour generator.

Analogue input – This allowed the user to introduce external sounds, Such as a vocal, through the mini moog and manipulate them with the moog's powerful oscillators and filters.

Output Amplifier – This is where the resultant tone generated by the mini moog, is amplified and sent to a loudspeaker. The signal that is heard is the result of all original Oscillator signals, noise and any subsequent filtering. There is also a separate Headphone Output amplifier.

## Block diagram

(Source of image <http://www.soundonsound.com/sos/jun01/images/fig01minimoogblock.l.gif>)



## Conclusion

Due to its robust build and use of analogue components, the mini moog soon became superseded by the array of sounds being generated using computer chips and algorithms. With the market for software based synthesisers booming, thus allowing producers to load up digitally modelled versions of analogue synthesisers at the click of a button, the mini moog is still widely considered within the music community as the synthesiser that put developers on the path to where we are today.