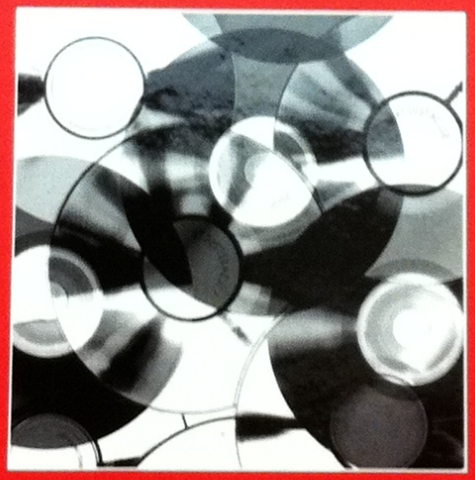
CONTINUUM ENCYCLOPEDIA OF POPULAR MUSIC OF THE WORLD



VOLUME II
PERFORMANCE AND PRODUCTION

continuum

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POPULAR MUSIC OF THE WORLD

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EDITED BY
JOHN SHEPHERD, DAVID HORN,
DAVE LAING, PAUL OLIVER AND PETER WICKE

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can be considered a mechanical precursor of the modern sequencer. A similar paper-tape mechanism, storing binary data, was used to control playback on the huge RCA Electronic Music Synthesizer, located at the Columbia-Princeton electronic studios, during the 1950s. Much electronic music of this period, however, was created by editing, splicing and looping electronic sounds recorded on magnetic tape.

With the introduction of modular synthesizers during the mid-1960s, it became possible to control the various electronic components through the application of variations in electrical voltage. The analog sequencer was developed to supply to a synthesizer a user-defined series of control voltages (altering the pitch of the oscillators) and gate signals (defining note durations by triggering envelope generators). Sequencers were often designed to repeat a short series of such voltage/gate steps – between eight and 16 steps in early analog devices – and thus, in operation, sounded much like the use of tape loops.

To increase the number of notes that could be produced by the sequencer and to attain greater flexibility in programming, a number of synthesizer designers began to experiment with microprocessor technology during the early 1970s. Among the most popular of the early digital sequencers was Roland's MC-8 Microcomposer, introduced in 1977. Based on design prototypes developed by Ralph Dyck, an independent commercial composer and studio owner working in Vancouver, Canada, the MC-8 had the capability of outputting eight discrete channels of control voltages and had sufficient memory to produce more than 5,000 notes. Following Dyck's innovative design, the device used a numeric keyboard to enter notes and other musical data. Other sequencer innovations of the period included the development of systems for the autocorrection of rhythmic discrepancies and the chaining together of short patterns to create longer sequences, both introduced in Roger Linn's first drum machine, the LM-1, which began development in 1978 and was introduced to the marketplace in 1980.

In 1983, the introduction of MIDI – which allowed digital synthesizers and personal computers to be connected together – created the conditions for the development of the next generation of hardware and software sequencers. These sequencers output MIDI data, rather than control voltages, and can be used to control virtually every aspect of a synthesizer's sound-generating capabilities.

Based on its earlier experiments in designing sequencer-like software for personal computers, Passport Designs introduced the first MIDI sequencer program in 1984. With the increased emphasis placed on the use of simultaneous, multiple channels of MIDI data and the already-established practise of multitrack recording in popular music production, most software programmers adopted the multitrack tape recorder as a metaphor in designing the user interface for sequencer software: the process of inputting MIDI data simulates the practise of recording and overdubbing on a multitrack tape deck (there are even on-screen buttons for record, playback, fast forward and rewind functions), and the data are usually arranged as a series of linear 'tracks.'

The use of sequencers has had a profound impact on a number of popular music genres. During the 1970s and early 1980s, the repetitive patterns and rhythmic precision characteristic of early sequencers became part of the aesthetic of much psychedelic and electro-pop music. Digital synthesizers, drum machines and software sequencers have likewise become essential components in the production of techno and other genres of dance music since the 1980s. Outside these specific genres, the increased use of computers in recording studios during the 1990s has made sequencing software an integral part of recording practise in a wide range of popular and commercial music production.

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PAUL THÉBERGE

Sound Recording Technologies

The technology of sound recording dates back to the late 1800s. The wax and tinfoil cylinders, precursors of the modern phonograph, were among the influential inventions that heralded the end of the nineteenth century and the start of the twentieth century. Communications technology was coming into its own, with initial development of the telephone, telegraph, radio and phonograph occurring during the late 1800s. These inventions were not unrelated. Thomas Edison, who, it is generally agreed, invented the phonograph in 1877, was in some measure involved in the research and development of all of them, as were Alexander Graham Bell and Emile Berliner.

That these inventions were related is not surprising. The driving force behind these communications technologies (and the radio) was the desire to transmit the human voice. One of the earliest uses of the phonograph was for dictation and transcription.

Prior to the phonograph, music notation was the only means, apart from memorization, of preserving a composition. Musical boxes existed, but they could not be said to have 'recorded' music. They relied on a process that involved the repeated striking of small keys or other resonating objects – a process much the same as that used in piano rolls, whereby a piano's keys were guided by a perforated roll of paper, each perforation corresponding to a key. Neither device qualified as an instrument for sound recording simply because they did not fix and store sound.

The first technological method of sound recording dates back to 1857 when Leon Scott, a French scientist, developed the phonautograph. This instrument used a hog's bristle, attached to a diaphragm located at the small end of a conical horn, to cut lateral grooves into a cylinder of heavy paper coated with lamp black. A person could shout into the horn and rotate the cylinder by hand, thereby 'writing' the sound (hence the term 'phonautograph'). Scott, however, had no provision for playing the sound back.

In July 1877, Thomas Edison filed for a patent for a telephonic repeating device with the British patent office. The method was similar to Scott's, although Edison used tinfoil as the medium upon which grooves were cut by a stylus.

The early phonograph was greatly lacking in fidelity. The device would both record and reproduce sound by means of a large acoustic horn (now familiar to many people only from the 'His Master's Voice' logo), thereby necessitating strong sound sources to provide adequate levels of loudness. Yet the sound could not be too loud, since the stylus carved pits into the cylinder and could not be allowed to cut too deeply lest it damage the medium.

The phonograph enjoyed startling popularity from the day of its first public exhibition. Some machines were outfitted with coin slots and sets of hearing tubes with which up to 17 people could listen to a recording.

However, problems lingered. Since the phonograph was initially developed for reproduction of the human voice, with its limited frequency and dynamic range, lack of fidelity limited its popularity – as did the short supply of recordings. The novelty of hearing a recording of the human voice wore off quickly, and technical improvements became necessary if the phonograph was to become an instrument for recording music with any degree of fidelity. Of equal importance, there was no means for mass-producing recordings. Each cylinder could be made only from a unique performance, and to mass-produce cylinders multiple cylinder recording machines had to be arranged in front of the performers. For 100 cylinders to be made, a performer had to play a piece of music 10 times in front of 10 recording machines.

The next step in the phonograph's evolution came from Edison's archrival, Alexander Graham Bell. He developed the graphophone, a device virtually identical to Edison's tinfoil phonograph, except that it used wax-covered paper and not tinfoil. Instead of indenting grooves into tinfoil, the graphophone cut grooves into the wax. The graphophone patent, issued in 1886, included this distinction between indenting and incising, and was the progenitor of the modern phonograph record. Bell also developed a system whereby a jet of compressed air amplified sound reproduction, and a mechanism by which the cylinder could be rotated at a variable speed.

By 1895, with the help of inventor Ezrah Gilliland, Edison had developed an improved, spring motor-driven phonograph. Gilliland had also been working on another invention he called the 'spectacle.' This device allowed for immediate switching between recording and reproduction on the phonograph. The spectacle was important for the phonograph's use as a dictating machine, but the principle of immediate reproduction/recording remained central to subsequent recording machines like the cassette deck.

During this time, German-born inventor Emile Berliner, inspired by Scott's phonautograph, was working on the gramophone, the direct ancestor of the phonograph, as it became known after the turn of the century. Berliner used a method of photoengraving to etch grooves onto a metal plate. Since he first had to make a metal cylinder for recording, straighten it out for photoengraving, then roll it up again for reproduction, he eventually did away with the cylinder and opted for the convenience of recording on a flat disc instead. Berliner also did away with the photoengraving process, replacing it with a method of plating and duplicating discs similar to the one used in contemporary record pressing plants.

Berliner solved several problems faced by the early phonograph industry. First, he made possible the duplication of records from one master record. The result was the mass production of recordings, which set the scene for the rise of the recording industry. Another result, however, was the separation of recording and reproduction. Second, the recording of discs was no longer a directly acoustical process, but partly a mechanical one. Although the master record's grooves were cut by the stylus, each subsequent record's grooves were not. The grooves were etched by the acid bath, and not cut into the disc by the acoustical energy acting upon the stylus. Third, Berliner's method used grooves that spiraled around the disc and moved laterally, not up and

down, increasing fidelity. The result was that louder sounds could be recorded and correspondingly louder volumes reproduced.

Between 1879 and 1885, Bell, while working on the graphophone, attempted magnetic recording and succeeded in recording on tape. Perhaps due to Edison's moderate success with the phonograph, however, Bell abandoned magnetic recording in favor of cylinder recording.

The first practical magnetic recorder was invented by Danish inventor Valdemar Poulsen in 1898, and patented in America in 1900. Its connection to the phonograph is unmistakable, as it employed a cylinder wrapped with magnetic wire. A recording head revolved around the cylinder, magnetizing the wire. Even the name Poulsen chose for the device, the telegraphone, places it alongside the phonograph and telephone.

The general principle of magnetic recording rested on the polarization of metallic particles on a piece of wire (later a length of tape). The orientation of the particles could be altered by passing the wire before a magnetic recording head (itself magnetized by an electrical current resulting from acoustical energy), thereby encoding a signal on the wire. Passage of the wire before a playback head, one sensitive to the particles' orientations, resulted in a reversal of the process. The magnetized particles would set up an electrical current which could be converted into sound.

Several important differences from the phonograph were apparent in magnetic recording. First, the wire could be erased by passing it through a strong magnetic field and could be recorded over without difficulty. By contrast, the wax on a cylinder or disc had to be melted before re-recording could be done.

Second, the recording was of a strictly electrical nature, as opposed to the phonograph's mechanical form of reproduction. The phonograph took sound and converted it into mechanical energy to encode the sound in the form of grooves on a cylinder or disc. The signals encoded onto the magnetic recorder's wire were converted from mechanical energy to electromagnetic energy.

Perhaps most importantly for popular music's development, the magnetic recorder's wire was more suitable for editing and splicing. A phonograph record could be edited only in crude fashion, by starting and stopping it during recording or by attaching different cylinders. Audible pops and clicks would give away the edit points, however. A wire or tape could be cut and reattached with greater ease and better fidelity. And, importantly, minute sections could be cut and reassembled.

Work on magnetic recording proceeded slowly, in part because there was a concentration on improving the phonograph in the early 1900s, and because the phonograph's acceptance as a device for both recording and reproducing sound meant that there was no concentrated research effort into new methods of recording.

In 1927, J.A. O'Neill received a patent for paper tape coated with a magnetic liquid, and German inventor Fritz Pfleumer developed a metallic oxide formula that adhered to paper. The stage was set for inexpensive magnetic tape. Paper magnetic tape was also extremely easy to edit and splice.

Magnetic tape itself was invented by AEG Telefunken and BASF (who first used it commercially), and presented for the first time at the Broadcast Exhibition held in Berlin in 1935. During World War II, both the Allies and the Nazis showed an interest in magnetic recording. The potential military use foreseen was, in an interesting parallel to initial predictions about the phonograph's usefulness, as a dictation system for pilots. Contrary to the assertion in most audiophile histories, magnetic tape recording was not *invented* in Germany to record Hitler's speeches; it was *perfected* there.

The mass production of tape recordings was made possible in the early 1950s, when the Ampex Corporation developed a high-speed tape copying system that could dub as many as 10 tapes at a time running at 16 times normal speed. The system was purchased immediately by RCA and Capitol Records.

As refinements continued to be made to tape recorders, different recording formats appeared. The first tape recorders could record only monophonic sound in one direction. By the early 1950s, tape heads had been developed that could record on half the width of the tape, so that it could be reversed and the other half recorded on as well. This, in turn, led to the development of two-track stereo tape recording. Stereo eventually became the high-fidelity standard. Because of mechanical difficulties, the stereo disc was not introduced until 1958 – and then it caused some confusion, primarily due to questions of its standardization and compatibility with monophonic equipment. The phonograph had not seen such innovation since the switch from acoustic to electrical phonographs in the 1920s, when the vacuum tube allowed efficient amplifier design.

With the addition of an electrical amplifying circuit as a transducer between the acoustic sound and the mechanical action of the stylus, electrical recording and reproduction made it possible to control loudness.

Recording cartridges were developed in 1930 to make threading wire recorders less difficult, but they were not incorporated in tape recorders until the late 1950s, as a means of ensuring the continued acceptance of tape despite the popularity of the stereo disc. RCA announced in

1958 that it had developed a tape cartridge that played 32 minutes and would retail for about a dollar more than a stereo disc. RCA's cartridge was the precursor of the eight-track cartridge. Although the eight-track cartridge was mass-produced in the 1960s and 1970s, it did not find acceptance among consumers. It was difficult to use for recording and it did not have an efficient means of fast-forwarding and rewinding the tape. A form of the eight-track, referred to colloquially as the 'cart,' became standard equipment in the radio industry for announcements, station identifications and advertisements.

The most widely accepted tape cartridge format to date, the cassette, was introduced by the Philips Company in 1963. To ensure standardization of the cassette format, Philips gave up manufacturing rights to anyone wanting to produce cassettes, provided they used Philips' specifications. By 1965, several companies were making cassette recorders, and reviews were favorable. Cassettes were relatively inexpensive compared with both LPs and reel-to-reel tape recorders and, as shown by the wide variety of people reportedly using them, were easy to operate. Recording was no longer solely in the domain of the technician or hi-fi enthusiast.

The transition from two-track tape decks for stereo recording and reproduction to multitrack recording was relatively quick. In 1958, a four-channel tape recorder was introduced by the Shure Brothers company. It allowed recording and playback of two separate stereo programs, one in each direction.

By 1970, engineers had adapted the four-channel system for playback in one direction, creating four-channel, 'quadrisonic' ('quad') sound. The process was difficult to duplicate with discs (like stereo, it was first available only on tape), and required special encoding and decoding equipment. Quad sound did not catch on with the public and was not well supported by the recording industry.

The four-channel recording system remained, however, and became the backbone of the recording industry. By 1967, the eight-track recorder had become the studio standard, followed by 16-, 24-, 32- and 48-track. Prices had dropped on most multitrack decks by 1980, and companies like Tascam and Fostex were aiming products like the Tascam Portastudio – a small, inexpensive four-track recorder that used cassettes – at amateur and semi-professional musicians. These units usually included a small mixing console for combining the sounds from the four tracks, and their list price was in the $1,000-$1,500 range. In 1985, Fostex introduced an eight-track deck at a list price of $1,600. Studio recording was no longer confined to the studio, and the home recording studio became financially possible.

In the early 1980s, digital audio recording began to become commonplace. Though a seemingly recent phenomenon, digital audio recording's history goes back to the invention of magnetic tape. A common use of magnetic recording was for computer data storage and instrument recording. And, of course, Morse code was the first practical digital code, consisting of dots and dashes (that is, binary ones and zeros, just as digital code for audio and data recording consists of a stream of ones and zeros).

Digital recording was not practical until the microprocessor was invented, primarily because of the enormous amount of data that had to be sorted for conversion from analog to digital and back again. By the late 1970s, microprocessors were abundant and inexpensive enough that the recording industry could begin to use them, and combinations of disc drive and tape recorders made their way into recording studios.

The audio quality of digital recordings is remarkable. Both standard (analog) tape recording and disc recording had an inherent amount of noise in the background – tape hiss for the former, and pops and clicks for the latter. Digital audio, however, is free from such noise. Although professional digital recording machines use tape to store the digital signals, the sound is not bound to the tape's limitations since it is not the signals on the tape that are reproduced (instead, the *information* is processed). By the mid-1990s, much recording was being done directly to computer hard discs, thereby eliminating the need for tape (and potential mechanical problems associated with that medium) and allowing ever-increasing manipulation of recorded music, once it was in the domain of the computer.

Consumer electronics companies initially marketed digital audio with the compact disc (CD) at the 1977 Tokyo Audio Fair. The CD was primarily a playback-only medium, consisting of an optical disc scanned by a laser. Later developments facilitated its use as a recording medium. Other optical-storage media, most notably the minidisc (MD) and the digital versatile disc (DVD – the most likely medium to supplant the CD), soon followed. Optical-storage media are particularly robust as no mechanical contact with the medium is required for recording and playback, thereby increasing longevity.

Tape recording did not disappear, however. Digital audio tape (DAT) became very popular for professional audio production, and found a niche as a data backup medium in computing applications. It did not, however, penetrate the consumer market. In 1991, several semi-professional equipment makers, including Tascam, Akai and Alesis, introduced digital multitrack recorders for the home recording studio. This represented another advance in achieving recording quality at a lower price,

and it blurred the distinction between professional and amateur recording equipment.

Digital workstations, machines that record audio directly to a hard disc, have found particular favor in the audio and video postproduction industries, primarily because they are 'all-in-one' systems that embody sound recording, editing and synchronizing all in the digital domain. Although there has been occasional criticism of digital recording as sounding 'harsh' or 'unmusical,' most recordings since the mid-1990s have employed some form of digital recording at some point during the recording process. It is likely that ongoing developments in digital recording technology will continue the trend toward increased storage capacity and microprocessor power, thereby enabling more information to be stored and, presumably, making possible greater fidelity.

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STEVE JONES

Sound System

At the heart of reggae lies the sound system. In the early days of the phenomenon, during the late 1940s and early 1950s in Jamaica, a sound system was scarcely more than a turntable, an amplifier and a pair of speakers, playing the latest in US rhythm and blues (R&B) (sprinkled with the odd swing and calypso title) before a largely working-class audience. At the beginning of the twenty-first century, the 'sounds' (as they are commonly known) can be large-scale entertainment packages, replete with powerful equipment and crew, touring internationally and attracting a large and enthusiastic following, not unlike supporters of a soccer team. Popular sound systems may consist of more than one 'set' of equipment, enabling simultaneous performances in more than one location. Whether large or small, however, sound systems are the most central institution in reggae, the focal point of audiences and artists alike.

From the start, exclusivity was at a premium. Being able to play obscure US records was one sure way of staying ahead of the fierce competition. As the supply of suitable – i.e., rare – discs began to dwindle in the late 1950s – due in part, paradoxically, to their increased availability (greater numbers of informal importers, larger quantities) and to changing tastes in the United States (rock 'n' roll superseding the beloved 'boogie' of the late 1940s and early 1950s) – creating one's own original material became a necessity. Thus, early sound system entrepreneurs soon found themselves to be the backbone of a fledgling recording industry. Leading operators, such as the legendary Coxsone 'Downbeat' Dodd, Duke 'The Trojan' Reid and Prince Buster, were effectively Jamaica's first record producers. Adaptations of US R&B, mixed with local idioms such as *mento* and calypso, metamorphosed into ska, arguably Jamaica's first modern popular music style (and before long the first indigenous staple of the sound systems).

In the sound systems, a distinction between 'selectors,' who spun the records, and 'DJs,' who talked in between and over them, began to emerge. With the phenomenal success of U Roy (and a host of other DJs in his wake) around 1970, DJing (or 'toasting') on record became reggae's most popular idiom. As virtually anyone, in the permissive environment of the dance hall, could practise being a DJ by chatting over the 'version' sides of the records, young hopefuls were plentiful. Thus, the sound systems became not just the major vehicle for the dissemination of popular music in Jamaica, but also its most important recruiting and testing ground.

In the early 1980s, as the emphasis shifted toward performers rather than the records being played, the sound systems became a showcase for live DJs and (to some extent) singers. Many (but not all) of the performers that were popular in the dance halls went on to become highly successful recording artists as well. In the late 1980s, the 'rhythm' phenomenon took off in earnest; that is, sound system selectors began stringing together different cuts of popular 'rhythms' – the common musical backgrounds that underlie virtually all reggae – into uninterrupted sequences of dance music, a practise known as 'juggling.' In so doing, successful selectors took center stage, becoming stars in their own right. The DJs largely retreated to the recording studio (and to stage shows).

One striking aspect of sound systems' interaction is their intense rivalry, institutionalized in oft-occurring 'clashes,' major ones taking place not just in Jamaica, but in London, New York and Yokohama as well. A clash