TIME FLASHES: A SHORT HISTORY OF SOUND AND LIGHT TECHNOLOGY

by Michael Hutchison

To those seeing them for the first time, sound and light devices may seem bizarre, like something out of a science fiction movie--the users seem laid back, out there somewhere, wired into a small box listening through headphones to some unheard sounds while eerie light pulsations flicker inside futuristic goggles. And to those encountering these devices from a background of meditative practice, the idea that one can attain heightened or meditative states of consciousness by using a machine, and the sheer technical computerized hardware of the devices themselves, must seem coldly materialistic. But while the hardware may seem new, the techniques being used are ancient.

LIGHT

The knowledge that a flickering light can cause mysterious visual hallucinations and alterations in consciousness is something humans have known since the discovery of fire. It must have been knowledge of great value to the ancient shamans and poets, who learned how to use the images in the flames to enhance their magic. Ancient scientists were also intrigued by this phenomenon, and explored its practical applications. In 125 A.D. Apuleius experimented with a flickering light stimulus produced by the rotation of a potter's wheel, and found it could be used to reveal a type of epilepsy. Around 200 A.D. Ptolemy noted that when he placed a spinning spoked wheel between an observer and the sun, the flickering of the sunlight through the spokes of the spinning wheel could cause patterns and colors to appear before the eyes of the observer and could produce a feeling of euphoria.

Light researcher David Siever has found that in the 17th century, a Belgian scientist, Plateau, used the flickering of light through a strobe wheel to study the diagnostic significance of the flicker fusion phenomenon. As he caused the light flickers to come faster and faster, he found that at a certain point the flickers seemed to "fuse" into a steady, unflickering light pattern. Plateau discovered that healthy people were able to see separate flashes of light at much higher flicker speeds than were sick people. (In recent years, studies using light sources such as a tachistoscope to provide rapid light flashes have revealed that long-term meditators are able to see discrete flashes of light at much higher flicker rates than non-meditators.) At the turn of the century, French psychologist Pierre Janet noticed that when patients at the Salpetriere Hospital in Paris were exposed to flickering lights they experienced reductions in hysteria and increases in relaxation.

SOUND

Similarly, humans had always been enthralled by the effects of rhythmic sounds, and aware of the mind-altering and brain wave entrainment effects of rhythmic noises, as evidenced for example by the sophisticated auditory-driving techniques developed over thousands of years by shamans and priests. As anthropologist and shamanism authority Michael Harner, points out, "Basic tools for entering the SSC [Shamanic State of Consciousness] are the drum and

Researcher Andrew Neher investigated the effects of drumming on EEG patterns in the early 1960s and found the rhythmic pounding dramatically altered brain wave activity. Other researchers of shamanistic rituals, Harner observes, have "found that drum beat frequencies in the theta wave EEG frequency range . . . predominated during initiation procedures."

And humans have always been keenly appreciative of the consciousness-heightening powers of music, which is of course, among other things, a succession of rhythmic auditory signals. For thousands of years musicians and composers have consciously and intentionally influenced the brain states of listeners by manipulating the frequency of the rhythms and tones of their music.

SOUND AND LIGHT TOGETHER

Humans have also long been intrigued by the possibilities for influencing mental functioning that emerge from combining both rhythmic light and rhythmic sound stimulation. Ancient rituals for entering trance states often involved both rhythmic sounds in the form of drumbeats, clapping or chanting, and flickering lights produced by candles, torches, bonfires or long lines of human bodies rhythmically dancing, their forms passing before the fire and chopping the light into mesmerizing rhythmic flashes. Some composers of the past, such as the visionary Scriabin, actually created music intended to be experienced in combination with rhythmic light displays.

Technological advances made possible even more powerful combinations of sound and light. Moving pictures developed

Modern scientific research into the effects of rhythmic light and sound began in the mid-1930s when scientists discovered that the electrical rhythms of the brain tended to assume the rhythm of a flashing light stimulus, a process called entrainment. Research shifted into high gear in the late 1940s when the great British neuroscientist W. Gray Walter used an electronic strobe and advanced EEG

equipment to investigate what he called the "flicker phenomenon." He found that rhythmic flashing lights quickly altered brainwave activity, producing trancelike states of profound relaxation and vivid mental imagery. He was also startled to find that the flickering seemed to alter the brain-wave activity of the whole cortex instead of just the areas associated with vision. Wrote Walter: "The rhythmic series of flashes appear to be breaking down some of the physiologic barriers between different regions of the brain. This means the stimulus of flicker received by the visual projection area of the cortex was breakiing bounds--its ripples were overflowing into other areas." The subjective experiences of those receiving the flashes were even more intriguing: "Subjects reported lights like comets, ultra-unearthly colors, mental colors, not deep visual ones."

Walter's research aroused the attention of many artists, including the American novelist William Burroughs, and they put together a simple flicker device called the Dreammachine. As Burroughs described it in the 1960s, "Subjects report dazzling lights of unearthly brilliance and color. . . . Elaborate geometric constructions of incredible intricacy build up from multidimensional mosaic into living fireballs like the mandalas of Eastern mysticism or resolve momentarily into apparently individual images and powerfully dramatic scenes like brightly colored dreams."

A flood of subsequent scientific research in the 1960s and 70s revealed that such flicker effects at certain frequencies seemed to have amazing powers. Various scientists discovered that such photic stimulation could have a variety of beneficial effects, such as increasing I.Q. scores, enhancing intellectual functioning and producing greater synchronization between the two hemispheres of the brain. Other researchers found that the addition of rhythmic auditory signals dramatically increased the mind-enhancing effects.

Throughout history technological advances, such as those in cinema, have quickly been seized upon to stimulate the human fascination with rhythmic sound and light. Throughout the 1970s and early 1980s, technological advances also made it possible for scientists to understand more fully how sounds and lights influenced the electrochemical activity of the brain. The result was the flood of studies mentioned above, dealing with photic and auditory entrainment, and hemisperic synchronization.

In the early 1970s, Jack Schwarz, known for his feats of self-healing and self-regulation, began selling a device known as the ISIS, which used varible frequency lights mounted in goggles combined with rhythmic sounds to produce heighted mental states. In 1973, scientist Richard Townsend published a description of his research with a device using goggle-mounted lights for photic entrainment. In 1974 a scientist at City College of New York, Seymour Charas, obtained the first patent on a combined sound and light stimulation device, though it was never put into commercial production. But by the early 1980s the time was right for a breakthrough in the combination of sound and light.

The catalyst was the revolution in microelectronics that was taking place at that time, a revolution that allowed home electronics buffs and garage inventors to put together astonishingly sophisticated and complex devices for producing and combining sound and light—devices that could produce a rich assortment of tones, chords and even beat frequencies; that permitted the selection of a variety of light-flash patterns and intensities; that enabled the user to select the mode of interplay between lights and sound; that contained a number of preset “programs” designed to produce specific states of consciousness, ranging from sleep to meditation to extreme alertness, at the push of a button; and that permitted the users to design and store in the device’s computerized memory a variety of their own programs. Before the breakthroughs in microelectronics, such complex computerized devices would have been enormously expensive to build, and like the old UNIVAC vacuum-tube computers, their circuitry and components would have been huge and unwieldy. But these new sound and light stimulators were relatively small—some of the first models were about the size of a portable typewriter; soon models were being made with consoles not much bigger than a pack of cigarettes.

As happened with personal computers, there seem to be new advances, new machines, and new generations of older devices appearing almost constantly; and as with PCs, the advances have included smaller size, greater versatility and power, and steep reductions in price. As this is written, there are well over 20 sound and light machines in commercial production around the world, and we seem on the verge of an entirely new generation of devices that combine sound and light stimulation with biofeedback capabilities. These new devices enable the machine to read the user's dominant brainwave activity, and then provide the optimal frequency of sound and light to entrain brainwave activity toward the "target" frequency. One such device (the DreamWave) is already on the market.

Another significant development is the advent of a sound and light system on a simple board that can be plugged into your computer's expansion slot. One example currently on the market is the MindsEye Synergizer, a hardware-software combination that turns an IBM PC XT/AT/386 or clone into a research laboratory grade audio-visual synchronizer, permitting users to program hundreds of sessions of almost any length and complexity, to program each eye and ear independently (this permits extraordinary effects, such as combining alpha and theta frequencies, or setting up visual "beat frequencies"), create sounds, chords and beat frequencies on the computer with a stereo synthesizer, and program thousands of time ramps and sound-light levels into a single session.

These developments point the way toward the future. I believe it will be only a short time until we have a fully computerized integrated and interactive system that would allow the user to put on a few electrodes that would monitor EEG as well as other physiological indicators (muscle tension [EMG], skin potential, heart rate, skin temperature, breathing, etc.) and display them on the computer screen in real time;

would use this information to provide the optimal type of sound and light stimulation (as well as cranial electrostimulation and appropriate digitized music selections or preprogrammed audio suggestions, hypnotic inductions, information for accelerated learning, etc.); and would permit the storage of thousands of sessions, with individual users able to select desired mind states or experiences with the ease of selecting a channel on the TV, or play back or re-experience past sessions. The technology for such a system is already available.

SOUND AND LIGHT RESEARCH

It has been well established that these devices can rapidly produce states of deep relaxation, and may increase suggestibility, receptivity to new information, and enhance access to subconscious material. New work into the effects of these devices being undertaken around the world, and preliminary results suggest that the machines may of being beneficial in the treatment of migraine headaches and learning disorders, alleviation of pain, enhancement of immune function, and much more. Here's a summary of some of the most interesting work done in the last decade.

In one preliminary 1980 study of one of the sound and light machines, Dr. Thomas Budzynski, then of the Behavioral Medicine Associates clinic in Denver, found that "Results ranged from production of drowsy, hypnagogic-like states (with theta frequency used), to vivid, holograph-like images. At times, images from childhood were experienced." This led Budzynski to speak of the device as a "Hypnotic Facilitator," and a "Facilitator of 'Unconscious Retrieval," that could have therapeutic value, since the device seemd "to allow the subject to recall past childhood events with a high degree of 'being there' quality." He also suggested that the device could be effective for accelerated learning, since it seemed capable of putting users in the theta (or "twilight state") of hypersuggestibility and heightened receptivity to new information.

Medical researcher Dr. Gene W. Brockopp of Buffalo, New York, speculated that sound and light stimulation could perhaps "actively induce a state of deactivation in which the brain is passive, but not asleep; awake, but not involved with the 'clutter' of an ongoing existence. If this is true, then it may be a state in which new cognitive strategies could be designed and developed." Brockopp also suggested that "If we can help a person to experience different brain-wave states consciously through driving them with external stimulation, we may facilitate the individuals' ability to allow more variations in their functioning through brreakup up patterns at the neural level. This may help them develop the ability to shift gears or 'shuttle' and move them away from habigt patterns of behavior to become more flexible and creative, and to develop more elegant strategies of functioning."

In 1988, anethesiologist Robert Cosgrove Jr., Ph.D., M.D., undertook preliminary studies of sound and light stimulation. In his initial evaluations, in which he used the Alpha-Pacer II device, Cosgrove, an authority in pharmaceutics and biomedical engineering, noted that audio-visual stimulation was "clearly very powerful in its ability to cause deep relaxation in most subjects. Its effectiveness has been so great that we are very enthusiastic about the prospect of evaluating the [device] for its sedative properties in patients prior to, during, and immediately following surgery. We are also undertaking studies to prove [its] utility in chronic stress."

"We are also," Cosgrove continued, "quantitating the electroencephalographic (brainwave, EEG) effects... in both volunteers and patients. Our preliminary results show strong EEG entrainment."

The device, Cosgrove noted, "with appropriately selected stimulation protocols has been observed by us to be an excellent neuropathway exerciser. As such we believe it has great potential for use in promoting optimal cerebral performance. . . . Furthermore, the long-term effects of regular use of the device on maintaining and improving cerebral performance throughout life and possibly delaying for decades the deterioration of the brain

In 1989, another researcher, D.J. Anderson, used photic stimulation using red LED goggles to treat seven sufferers of migraine headaches--none of whom had been able to relieve their migraines with drug treatments. He found that out of 50 migraines noted, 49 were rated by subjects as being "helped," and 36 sttopped by the photic stimulation. Significantly, brighter lights were found to be more effective.

Further evidence of the potential therapeutic value of photic stimulation has come from researcher Jill Ammon-Wexler, Ph.D., of the Innerspace Biofeedback and Therapy Center in Los Gatos, CA, using a device that uses a flickering light stimulus without an accompanying sound stimulus. The device, called a Lumatron, uses a strobe light with color filters to provide rhythmic photic stimulation in variable frequencies and in selected wavelength or color bands [MEGABRAIN REPORT will devote a full-length article to this device in a future issue]. Ammon-Wexler did a controlled study of twenty subjects suffering from phobias and found that "remarkable resolution of the subjects' phobic systems had occurred over the process of the 20 experimental sessions. There was also 'across the board' evidence for enhanced self-concept, and clinically-significant reductions in both anxiety and depression."

Dr. Ammon-Wexler's findings about the potential medical benefits of photic stimulation have been echoed recently by William Harris, M.D., director of the Penwell Foundation, an organization for the investigation, research and application of different modalities for the treatment of those with AIDS/HIV. In preliminary work

with a number of AIDs sufferers he has experimented with the use of a sound and light machine (the IM-1) and found it extremely effective. He speculates it may boost immune function by producing states of deep relaxation, by enhancing the patients' receptivity to suggestions for healing, by improving patients' ability to visualize and the clarity of their visualizations. "At this point it's conjecture," says Harris, "But I think that this type of machine may actually be stimulating . . . the body to produce its own chemical substances," and that these natural substances may enhance immune function and healing.

In 1990 Bruce Harrah-Conforth, Ph.D., of Indiana University completed a controlled study of one of the computerized sound and light machines (the MindsEye Plus) the result of over two years of research into the field of brain entrainment, and found that compared to the control group, which listened to pink noise with eyes closed, the group receiving sound and light stimulation showed dramatic alterations in their EEG patterns responding to the frequency of the sound and light device, and also showed evidence of hemispheric synchronization. Participants in the study were asked to describe their experiences. According to Dr. Harrah-Conforth, "the subjects' comments were such typical descriptions as 'I lost all sense of my body,' 'I felt like I was flying,' 'I was deeply relaxed,' 'I felt like I was out of my body,' etc."

The report by Harrah-Conforth suggests that sound and light devices may cause simultaneous ergotropic arousal, or arousal of the sympathetic nervous system and the cerebral cortex, associated with "creative" and "ecstatic experiences," and trophotropic arousal, or the arousal of the parasympathetic system, associated with deep relaxation and "the timeless, 'oceanic' mode of the mystic experience." In humans, Dr. Harrah-Conforth concludes, "these two states may be interpreted as hyper- and hypo- arousal, or ecstasy and samadhi."

In a separate letter to MEGABRAIN REPORT, Harrah-Conforth writes: "I have little doubt that brain entrainment technology is a highly effective means of inducing changes in consciousness." He continues, "Brain entrainment, at least within my own research, has shown itself to be virtually foolproof and does indeed facilitate whole brain experiences." While pointing out that our current understanding of brain entrainment technology is only in its infancy, he writes "there seems to be little doubt that this technology has a remarkable future. The evidence, my own and others, clearly indicates that brain-wave entrainment is produced by these machines. EMG tests have also made it quite clear that one of the byproducts of this entrainment can be the relaxation response. And subjective reports range from heightened creativity, to beautiful visual trips, to increased alertness, and many other states." He concludes that "the early indications are strong that this now-developing technology will profoundly revolutionize both our concepts of, and interaction with, our consciousness. . . . The evolution of human consciousness is a tangibly manipulable process. We can control our destiny. . . . It would appear as though brain entrainment will be among the technologies leading the way."

California psychologist Julian Isaacs, Ph.D., working with a private research group called "The Other 90 Percent," is now engaged in an ongoing study of the brain-wave effects of sound and light as well as other mind-altering devices. Megabrain, Inc. is providing assistance in this research by, among other things, making available a number of devices. Isaacs and his colleagues are using a 24 electrode color brainmapping EEG, with newly developed software that permits extremely precise and sensitive measurement and statistical analysis of whole brain electrical activity. In a discussion of his preliminary findings, he told me that there was "very clear evidence of brainwave driving" using sound and light. He also said he'd found a very strong correlation between the intensity of the lights used (whether red LEDs or incandescent bulbs) and the brain-entrainment: the brighter the lights, the more entrainment. He mentioned one device he had tested that used dim lights, and found it had "no brain driving capacity at all."

However, Isaacs pointed out that it was easiest to entrain brain-wave activity in the alpha range, while it seems much more difficult to drive the slower brain frequencies, such as theta (a fact discussed by the machine manufacturers in the roundtable discussion elsewhere in this issue). However, the EEG evidence was quite clear that people using the devices did indeed spend much of their sessions in theta. Often, however, their dominant theta frequency was very different from the theta frequency being flashed by the sound and light machine. How to explain this? Isaacs suggested the possibility that while the devices can clearly and quickly entrain brainwave activity into the low alpha range, what happens next is that the brain becomes habituated to the repetitive stimulus and the Reticular Activating System--the volume control and attention-directing part of the brain--simply tires of the repetitive stimulus and ignores it, or "blanks out" the conscious perception of the lights. As a result, the brain drops into the theta state.

The effect, that is, may be very much like that of the ganzfeld, which uses a featureless and unvarying visual field to cause the "blank out" effect. This theory brought to my mind the work of Dr. Gene Brockopp mentioned above, who suggested that sound and light stimulation could perhaps "actively induce a state of deactivation in which the brain is passive, but not asleep; awake, but not involved with the 'clutter' of an ongoing existence. If this is true, then it may be a state in which new cognitive strategies could be designed and developed."