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LIGHT AND SOUND PAUL EARLS

There are many sensed relationships between light and sound, but there are also very important physical differences. They travel at vastly different speeds: the speed of light is the fastest possible, whereas sound travels at about 300 meters per second, slow enough for an echo to be perceived. The human eye and ear respond to only a small portion of the physical spectrum - all part of the total electromagnetic spectrum, and the units of measurement we use are very different. We use Hertz and decibels in the case of the frequency and intensity of sound; nanometers and Lumens/Joules for light. This has led to a basic, but long-lived, false relationship between the two senses - that there exists a physical correspondence between certain frequencies of light and sound, and that both can be translated directly into the other. Newton participated in this mistake; he understood light very well, but not music.
Before the use of either Hertz or frequency, music was described in terms of 'pitch', i.e., what we now call Hertz/frequency. The mathematical relationships among pitches has been known since Pythagoras. If the physical character of a sound is doubled, it is duplicated at twice the frequency. This is called an 'octave' in non-scientific musical terminology. That term is so named because the two notes are eight lines/spaces from each other on the staff notation used in music, which, although it appears regular, is uneven - some graduations between lines and spaces are larger than others. Thus, a note whose frequency is 200 Hertz is said to be an octave higher if the frequency is doubled to 400 Hertz. The overtone series is based on such ratio relationships. Note that only one of these ratios is observed in Western music of the last 250 years - the octave. The overtone system demonstrates that there is an infinity of smaller and smaller musical intervals, all unique; the equal-tempered system smooths that out into equidistant intervals, all of which, except the octave, cannot be expressed in simple ratios. For example, the smallest musical interval is the l2th root of 2.
The world of light initially received the same terminology. What we now refer to as the interval of light frequencies, the nanometer, has a 400-800nm range visible to us. That led to the assumption that we see an 'octaves' range, and that there are seven distinct colors within that range, and, further, that each color has a musical equivalent.
There are many problems with this analogy, e.g., we respond to different colors with differing sensitivity. Blue requires less intensity to be seen as bright as red of a lower intensity. Perhaps the reason we use red as a negative symbol is because of its association with fire.

Our ears also respond in differing sensitivities to different frequency ranges. We require a great deal of energy in low frequencies; our most sensitive region is around 1000 Hertz - the range used by sirens, screams, and babies' cries. Also compare the things we can do with 'white' light and 'white noise'. Both have all frequencies present, but their division does not produce the same results.
In spite of these physical discrepancies, Synesthesia does exist for many people. But
not for me. The act of spontaneously producing sensations in another mode during the presence of one mode is well documented. Music has produced color and (ight sensations in many people; most notably Berlioz, Skrabine, and Kandinsky, This has led to color organs, the work of Thomas Mellers, and many others. And some music has been written to imitate and describe real-life events - trains, medical operations, animal sounds, factories, battfes, etc. Two visual artists' work is of particular unusual interest - Kandinsky's "Yellow Sound" and Munch's 'The Cry", as they are attempts to produce sound within the viewer. György Kepes used the examples of Bruegel paintings of peasant celebrations, which indicate music and laughter.
Early laser projections used a different, technical, technique. Mirrors were glued at right angles to two different loudspeakers, one producing horizontal lines, the other vertical. A laser beam was directed onto one and then onto the other mirror, which produced projected lissajous figures - a crude oscilliscope of the music. If the same sine wave was sent to the stereo set, a circle was formed; if an octave was sent to the pair, a figure 8 was drawn. If the two pitches were slightly out of tune, the figure slowly rotated, at the beat frequency. One of its chief problems (in addition to mirrors falling off loudspeakers or distorting their oscillation) was that bass notes produced larger patterns than higher pitches - exactly the reverse of our hearing sensitivity. However, this was the beginning of all laser projections, a technique now so well supported that there are many successful commercial organizations around the world who produce precise, computer-controlled galvonometer images of a type not possible before the invention of the laser beam.
I have been working in this field for the past 25 years, initially in collaboration with visual
artists, but most recently working in both images and music simultaneously. Three early works created at the MIT Center for Advanced Visual studies used the physical characteristics of a space to produce sound, using the vibrations in a room or box as a resonator. The first was "Sounding Space", which used electronic feed-back to make audible the Eigen-frequencies of a room. The second was a work in collaboration with György Kepes, the Director of CAVS. This came from his reading about the way in which certain experienced opera singers could

make the gas lights of opera houses flutter and strobe when singing certain notes - the Eigen-frequencies of the auditorium. Entitled "Flame Orchard", it consisted of a box filled with propane gas which had a top thin metal plate drilled with a grid of small holes, and with two loudspeakers broadcasting into the sides of the container. The escaping gas from the small holes was lighted, to make a sea of small flames, which then reacted to the music fed into the box. Like the opera singers, I had to learn the particular acoustic properties of the box, and composed electronic music that 'played' the flames. Note: I don't recommend this to anyone, as it is quite dangerous.

The third work was "Sound Floor" I made for a CAVS installation for the blind, where stepping on boxes on the floor using chess moves produced similar timbres - or silence. This was inspired by the difficulty blind people have in conceptualizing space.

There have recently been composers and artists who have also worked in both media:

graphic scores of the 1970s (Murray Shaeffer, John Cage, LaMonte Young, Nam June Paik) - I share a unique distinction of being listed in both Who's Who in Music and Who's Who in Art with Arnofd Schoenberg, John Cage, and Nam June Paik.

The case of Harry Partch is different, but of great inspiration to me. He insisted that the performance of music was a theatrical event, and that both the appearance of his invented, seif made just-intonation instruments, and their playing, were vital to the experience. My initiation into this point of view after my earlier work with Harry, and with electronic music, in the 1960s. When the performer was removed from the performance a great deal of confusion resulted. What were audiences applauding - if at all - the work or the tape machine or loudspeakers? Many attempts were made to use blinking lights on equipment to pretend that someone was in control - even John Cage did this.

We experience music very differently when we listen to it privately or with others. Ditto for movies. This is a feeling that something unexpected could happen, and that the audiences' presence might make a difference. This participatory element has now become standard for almost all contemporary multi-media installations - and even some movies. The missing element that I have worked on is to supply a visual element to the music, or a musical element to the visual. In both cases, this occurs in time, not as a static event. Instead of the approach taken in movie music (and most videotapes), my work does not involve specific relationships between the seen and heard, but a continuing relation/reaction on the part of both media. This is appropriate for music/gallery installations, where I do most of my work. There it is important to have a constantly evolving work, which may have repeating elements, but unlikely to have exactly repeating correspondences.

I will show a short series of still images of some of this work: Flame Orchard, Sounding Space, graphic notation, and laser projections, with a closing showing of a small laser projection of an image which György Kepes contributed to CAVS's Centerbeam sculpture for the 1977 Documenta VI. He suggested a closing and opening envelope with the message: "To Whom It May Concern". I will use the music I created for the Flame Orchard to modulate the image.