FROM . FILM MUSIC : A NEGLECTED ART A CRITICAL STUDY OF MUSIC IN FILMS
, ROY M. PRENDERGAST
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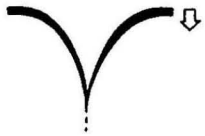
And its converse, *decrescendo:*



While Chuck Jones's concepts never found fruition in the commercial film industry, there have been film experiments in the area of sound and music since the earliest days of the sound film. These experiments have centered on the creation of sound using nonmusical means. There is little doubt that pure sound can take on many of the dramatic functions of music. The sound track to the Hitchcock film *The Birds* is a good example of this.

This idea of "music" created without benefit or in complement with traditional Western musical instruments is not new to the musician. George Antheil, who later wrote for Hollywood films, led a group of composers in Paris during the 1920s in an avant-garde musical movement. Their musical creations were called *musique concrète,* one of their more famous works being Antheil's *Ballet Mèchanique.*

In the realm of film, however, this idea was manifested in what is called "animated sound." This technique, as applied to the sound track of a film, is closely allied with the techniques employed in the production of animated films. Animated sound's most famous exponent has been the Canadian filmmaker Norman McLaren, but experiments in the field go back to as early as 1922.

It was in 1922 that I. Moholy-Nagy published some articles in Holland and Germany that discussed the possibility of the synthetic production of sound on film. Later, Ernst Toch, the German theoretician and composer, suggested the direct writing of sound without using the usual performers.

The available evidence seems to indicate that the first body of investigation and practical work in this area was done in Russia at the Scientific Experimental Film Institute located in Leningrad. It was here in 1930 that the musical theorist and mathematician A. M. Avraamov worked with two animators, N. Y. Zhelinsky and N. V. Voinov, on what they called "ornamental animation in sound." This same work was later carried on at the Leningrad Conservatory by G. M. Rimsky-Korsakoff and E. A. Scholpo. It appears that this group's work was rather extensive and pursued a number of different lines.

Avraamov used a frame-by-frame method that utilized a standard animation camera. Geometric figures such as rectangles and triangles were photographed; these were the basic units for his sound waves. The pitch of the sound was controlled by bringing the camera either closer or farther away from the drawings, or by preparing separate drawings for each pitch. The volume was controlled by varying the exposure. Harmony and counterpoint were achieved by multiple exposures, or by subdividing the sound track length-wise into sections, or by an extremely rapid alteration of several tones. *Portamento* was achieved by a rapid series of micro-tones.

Avraamov's chief aim was the freeing of his music from the restrictions of the twelve-tone well-tempered scale. He wished to create a new tonal system assimilating the many scales of the traditional folk music of the Eastern and Southern Republics of the U.S.S.R. He was able to achieve very accurate control over pitch and volume although his range of timbres was more limited. It should be pointed out that Avraamov was not looking for flexibility of timbre but rather for a limited number of new tone qualities that would arise naturally from the geometric shapes.

Soon thereafter Scholpo and Rimsky-Korsakoff began creating sound tracks for films by assembling small units of film and editing the music and sound effects into a whole.

At about the same time another Russian, B. A. Yankovsky, working in Moscow, developed a system in which he abandoned the frame-by-frame shooting on a standard animation camera in favor of continuously moving patterns. He was able to obtain these patterns through the use of rotating wheels with cog patterns.

Of all the Soviet animated sound techniques developed, animator N. Voinov's system is said to have been the most practical. Voinov had a library of eighty-seven drawings. These were graded in semitones covering a little over seven octaves of the twelve-tone, equally tempered scale but using a fixed tone quality of great purity. With this system he produced an interpretation of Rachmaninoff's "Prelude in C-Sharp Minor" as well as Schubert's "Moment Musical."

At about the same time as these Soviet experiments, a Munich electrical engineer by the name of Rudolph Pfenninger began work on his own system of animated sound. Pfenninger's system was similar to the Russians' although he apparently had no contact with them and developed his own system independently. Pfenninger also had a library of

cards with each drawing being of a single pitch and graded in semi-tones over a wide pitch range. These drawings were used as the basic unit for sound waves, sine-curves and saw-tooth forms. Pfenninger was able to achieve great control over dynamic nuances. One of the best examples of his work is the documentary film *Tönende Handschrift,* which was produced in the early 1930s.

During this same period and again in Germany the Fischinger Brothers in Berlin began photographing geometric shapes on the sound track. I. Moholy-Nagy was using alphabetical letters, people's profiles, and fingerprints as the basic graphic material for sound waves.

In 1933 a New Zealand musician, Jack Ellit, working in England, experimented along the same lines as Pfenninger and was the first to actually draw the sound directly onto the celluloid without the use of a camera.

In the United States during the early 1940s John and James Whitney created a prize-winning set of five films, entitled *Five Film Exercises,* which utilized the concept of animated sound. The sound tracks for these films were created by the filmmakers themselves using a pendulum device invented by John Whitney. Figure 6 is a photograph of this device. Whitney explained the technique: "The natural swing of the pendulum is literally a subsonic audio device, the swing of a pendulum being no different than the 'swing' of a string on a musical instrument. It was simply a matter of adapting that natural phenomenon of an array of pendulums and recording [photographing] their motion. It was a matter of recording the pendulums' motion and translating it into a variable area type of pattern on motion picture film. The motion picture film would be exposed, correspondingly, subsonic. That is, the film would be moving approximately 60 times slower than its playback speed."

After this initial effort in creating his own sound track, Whitney set aside the idea of creating his own music. Whitney recalls: "There were some inherent shortcomings to the pendulum device in that original form as an optical device. The biggest problem was the signal-to-noise ratio. There was always an inherent soundtrack noise that seemed to be technically impossible to reduce. We were unable to follow any of the procedures for noise reduction then being utilized by the commercial film industry because our system was essentially a mechanical one."

By this time Whitney had found that "the visual problems were comprehensive and enormous. I felt constrained to devote my entire attentions to the visual design problems."

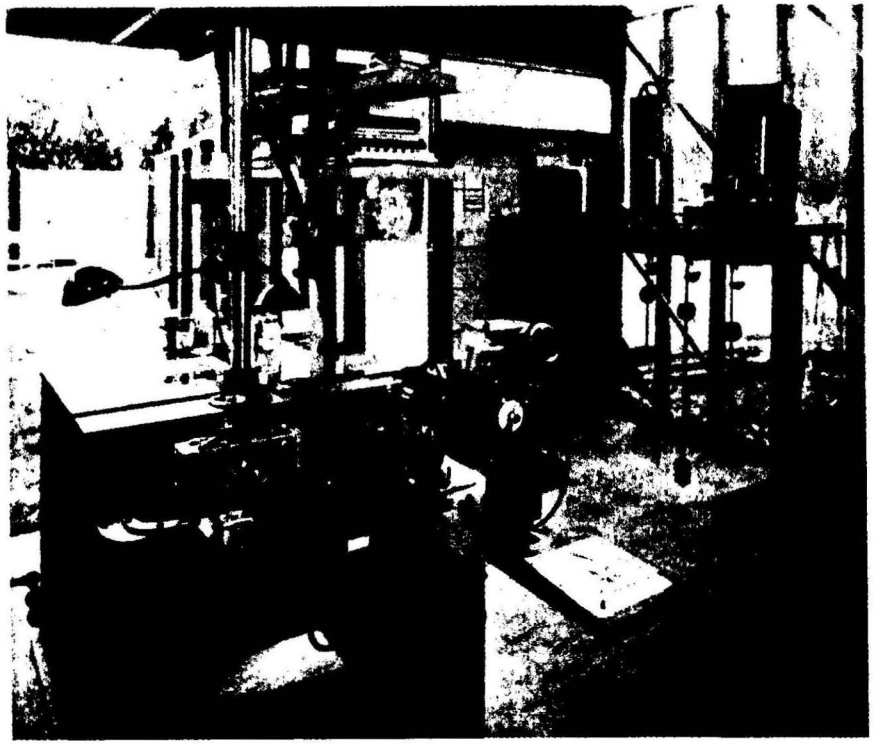


Figure 6. The machine on the right is the pendulum device invented by John Whitney. The device on the left is a visual one. Photo by John Whitney. Used by permission.

Whitney has, of course, continued his work in film; a discussion of some of his more recent work appears later in this chapter.

The person to devote the most time to this aspect of the sound track has been Norman McClaren, assisted by Evelyn Lambart, under the sponsorship of the Canadian Government. McClaren's system differs little from that of the Voinov and Pfenninger systems in that it uses a library of cards, each bearing the representation of sound waves. McClaren has streamlined the operation, however, to a point where it has become a simple and economic operation. He describes the process he uses in creating sound waves:

"There are many different ways of producing [sound waves]. For instance, it would have been possible to make them by recording (i.e.,

photographing) 'live' musical sounds on to film sound-track, then tracing the resulting patterns from the track. However, to do this would be as pointless and creatively stultifying as to make animated cartoons by photographing live actors and tracing their outlines. Instead, in the films under discussion [*Love Your Neighbor, Now is The Time, Two Bagatelles, Twirligig,* and *Phantasy*], a non-naturalistic approach was taken, with no particular attempt to imitate natural sounds or traditional musical instruments. New kinds of sound waves were made by using simple and easily drawn shapes.

"The drawings consist of a basic figure or simple shape, that is repeated over and over to form a patterned band. The figure may be no more than a white line on a dark ground or a single gradation of tone from light to dark, but, by virtue of its identical repetition, it builds up into a series of sound waves having a definite tone colour.

"Each card in the library of drawings carries one such band of repeated patterns on an area 1 inch wide and 12 inches long. On some cards the basic figure is repeated only about four times within this area and this, when photographed on one frame of film, will sound as a musical note of a fairly deep pitch (about two octaves below middle A). For midpitches there are from twenty to thirty repetitions of the basic figure on each card, and for very high pitched notes as many as 120.

"There is one card for each semitone of the chromatic scale, and in all, for the sound tracks of the five films mentioned, sixty such cards were used, covering a range of five octaves, from two octaves below middle A to three octaves above.

"These sixty cards were labelled with the standard musical notation and arranged systematically in a small box to form a kind of keyboard.

"When the music was being shot, the box was placed beside the camera so that the composer (who would also operate the camera), desiring a particular pitch, would select from the box the required card and place it in front of the camera.

"To get notes of a very deep pitch, the music was shot twice as fast as finally desired, and in the process of re-recording slowed down by half, and thus dropped one octave in pitch.

The Mosaic Nature of Music

"Because of the fact that a *picture* camera takes film intermittently by the frame (rather than running continuously as in the ordinary sound

recording equipment) the sound-track has a mosaic nature; in other words it builds up out of small units each 1/24th of a second long.

"If the duration of a note is desired longer, several successive frames of the same card are shot, thus building up a sustained effect, by a very rapid repetition of the same note, as in a harpsichord, a mandolin or xylophone; for a very short note, just one frame or at most two frames suffice.

"For rests and pauses a black card is photographed.

Dynamics

"Before exposing the film, however, the composer has to determine the precise volume or dynamic level of that note. This is one of the important new factors in animated music for, in the past, dynamic markings have never been written into traditional music scoring with any degree of precision.

"The standard *pp, p, mf, f, ff,* etc., indicate relative, approximate amounts of volume, and are never applied to every single note in a score, and their final determining is left to the interpreting artist; but in creating animated music the precise dynamics of every note in the score is the job of the composer; in other words the composer must also be the interpretive artist.

"To this end, 24 degrees of dynamic level were used (representing a decibel scale) and opposite each note in the score the number representing the desired dynamic level of that note was written.

"For instance, 0, 1, and 2, represent three differing degrees of *ppp;* 9, 10, and 11, three shades of *mp;* 12, 13, and 14, three degrees of *mf;* 21, 22, and 23, three degrees of *fff,* and 24 represents *ffff.*

"Subdivisions of these 24 degrees were constantly being used (particularly in crescendos and diminuendos) but were seldom written into the score. In local or rapid crescendos and diminuendos only the starting and finishing dynamic marks were written and the type of crescendos and diminuendos (such as 'arithmetical' or 'geometric') were indicated by a small sketch.

"The volume was controlled sometimes by manipulating the shutter or diaphragm of the camera and so affecting the exposure (variable density control) but more often by covering up the 1 inch-wide drawing until only ½ inch, or ¼ inch or other fraction of its width was visible (variable area control). Whichever method was used, the calibration was in decibels.

Tone-contouring

"Not only did the composer have the last and precise word on dynamics but he was also forced to specify the exact tone-contouring of each note; that is, what sort of attack, sustention and decay each tone was to have.

"This is important because even more than the basic tone quality of the note, the contouring of the note affects the "instrumental" effect. In traditional musical sounds, for instance, a piano note has a very rapid attack, no period of sustention, but a long period of decay; its contour is like a mountain peak with one very steep side, and one gently sloping side. A typical organ note has an abrupt attack, a prolonged sustention and a rapid decay; a contour rather like a plateau with a precipice at one side and a steep slope at the other. A tap on a wood block has a sudden attack, no sustention and a very rapid decay. Wind instruments are capable of much less abrupt forms of attack than percussion instruments. A violin, like the human voice, is capable of almost any kind of attack, sustention and decay.

"And so the composer, by giving a particular contour to each note, affected what would traditionally be called its instrumental quality. In practice this was done by placing black masks of varying shapes in front of the selected pitch card bearing the drawing of the sound waves; in this way we obtained about six kinds of tone-contour.

Tone Quality

"In the sound-track of *Love Your Neighbour* the range and variety of sound effects and tone qualities were considerably enlarged by using several supplementary sets of drawings, some of which had rising and falling pitches for portamento and glissando effects. Some drawings, though very simple to the eye, had a very complex sound wave structure, rich in harmonics, thus giving very strident and harsh sound qualities.

Harmony

"For several simultaneous musical parts either in harmony or counterpoint, three different methods were used. Either different drawings were superimposed on each other by several separate exposures, or the sound-track was divided lengthwise into several parallel strips and the different drawings shot alongside of each other in each strip. Alternatively each

musical part was shot on a separate film and the various parts mixed together during re-recording.

Acoustic Quality

"Animated sound produced by this method is normally 'dry,' or without resonance or echo. To achieve more resonance and to add acoustic quality two methods were used. The first, mainly for specific notes and localized or momentary effects, was done by shooting the same note on a rapid series of diminishing volumes (that is, the same drawing in smaller and smaller sizes); this simulates the natural effect of the sound waves bouncing back and forth from the walls of an instrument, room, hall, or cavern. The degree to which any particular note in the score can be placed in such an acoustical environment is controlled during shooting by the number and nature of diminishing replicas of the original drawings of that note.

"To obtain the general or overall acoustical environment, varying amounts of reverberation and echo were added, either electronically or acoustically during a re-recording.

"... it has been found in several cases more economical to make animated rather than live music, particularly for animated visuals. Close synchronization with previously completed visuals presents no problems, and subsequent changes and alterations to parts of the music can be made without the need to re-do the whole score, simply by re-shooting the particular notes affected."

Work with animated sound has not been carried significantly further (if that is indeed possible) in recent years and one finds filmmakers like John Whitney going back to traditional music or onward into computer technology. Whitney's film *Matrix,* for instance, uses some of the piano music of Antonio Soler. Whitney has, however, carried forward his concepts concerning similarities between the visual and aural arts. "At the outset the similarities obtain only in a visual world that is completely dynamic," he emphasizes.

During the late 1940s Whitney was awarded a Guggenheim Fellowship for two years. "During that time, [I] developed some spontaneous real-time animation techniques. I could manipulate paper cut-outs to music. I was working with jazz music that had no pretentions and none of the complexity and subtlety of structure of traditional Western art music. I was finding ways to satisfy my own concepts regarding the dynamics of

visual motion by ways that avoided the tedium, stasis, and the restrictions that you have with any cell animation or any conventional techniques. I was manipulating cut-outs and working with fluids, very much as they were later to be used in the light shows. I had an oil bath on a level tray with the light below. I put dye into the oil until it was deep red, and then used red-blind film in the camera. With my finger or with a stylus, I could draw on this thin surface of oil; drawing would push the oil away and the light would shine through so I could draw caligraphic, linear sequences very freely; and by selecting the weight and thickness of the oil, I could control the rate at which the line would erase itself, so that it was constantly erasing with a constantly fresh surface to draw on—the ultimate Tabla Rasa. I was doing that and manipulating paper cutouts, and then doing a lot of direct etching on film as McLaren had done. I made, during that time, half a dozen little films to classic jazz recordings such as Will Bradley's.

"At that time I was building much of my own equipment including a selsyn interlock system. The sound track was previously recorded, and it could be run backward and forward in interlock with the camera. The only cue I had as to my progress in making a film was what I could hear along the soundtrack; so I would rehearse two or three riffs of a piece, plan it more or less spontaneously right there and then shoot it; then back the film up to work another section or over the same section, or make a superimposure over that. Accumulatively, I was painting a complex moving image on film. I'd shoot complete three minute films in one afternoon's work."

The important thing about Whitney's work in this area was that it pointed to a kind of spontaneous performance—much like improvisation in music. Whitney points out that this system "pointed to something else: to give up film techniques entirely and begin to explore video techniques. I made a proposal in the early fifties at UCLA that we set up an arrangement with six or eight video cameras and six or eight performers using these various manipulation techniques—the cameras were to be mixed electronically—then we'd perform a real-time graphic experience as an ensemble. The very idea of an ensemble to 'perform' a visual art is quite valid. I think and hope it will happen some day."

In a film entitled *Permutations,* Whitney has consciously carried the consonance-dissonance (relaxation-tension) concept of music into the visual arts through the imaginative use of computers. Speaking of the dots

that create the graphics of the film, Whitney points up the similarities of the effect, created by the graphic figures, to some of the tensional effects created by music. Whitney says: "Every one of the points in *Permutations* is moving at a different rate and moving in an independent direction in accord with natural laws as valid as Pythagoras' while moving within their circular field. Their action produces a phenomenon which is more or less equivalent to musical harmonics. When the dots reach certain numerical (harmonic) relationships with other parameters in the equation, they form elementary many-lobed figures [see Figure 7]. Then they go off into a non-simple numerical relationship and appear to be random again. I think of this as an order-disorder phenomenon that suggests the harmony-dissonance effect of music. Graphically, as a static illustration in a book, it may not be as striking as it is to perceive the dynamics of the experience on film."

Whitney does, however, see the inherent fallacy of trying to invent a technology that would produce a musical counterpart to graphics or vice versa. For him, "music is sort of a narrow road I'd like to try to steer my own way through. I don't want to go in either of two directions. For example, I don't want to be mechanistic about art. And yet I'd like to begin to work with parallels which abound within the computer system for sound and image. Let me add, I am not composing music right now simply because I have my hands full with what I'm doing about the graphic formal problems."

Whitney rightly observes that creating some sort of musical score that would simultaneously generate a graphic countervoice would be "just as arbitrary to do as to invent a machine whereby I might compose the piano part while the machine does the violin part of a duo musical work. Yet all in all the great music of the future may well be heterosensuous."

In his more recent films Whitney has been trying to achieve the same kind of control that the composer has with music. I see the composer as an intuitive architect creating and manipulating aural material which has the effect of producing distinct feeling states on the listener. However, Whitney "agrees with Stravinsky that the problem of music is essentially one of architecture. A kind of spatial architecture. The emotional response is solely a by-product or a natural, inevitable development from that."

Whitney draws this concept into his film work, believing that "it is possible to create a spatial architecture that the eye can perceive and that

has the same kind of potential for emotive consequences as the most profound music."

Whitney also feels that he is gaining more and more control over the effects he wishes to create. He says: "I do have a cautious, unfolding confidence in being able to predict effects that I know will affect you. But one technical development that is urgently necessary is production in real-time. I think as soon as we have computer graphic systems that produce the kind of fluidity I'm presently able to generate, being generated in real time, then we're going to be able to achieve something fantastic. . . . Then we're going to really begin to make exciting film experiences. And I'm sure these developments will have revolutionary consequences for the composer and musical audiences though all this may be inconceivable to us right now. For example, we do not even clearly understand the relationships between the spontaneous and the cautious, the contemplative and the planned in musical art."

Whitney sees another relationship between the graphic structure of his film *Permutations* and musical structure: "Notice that in music, frequently the first hearing of a piece of music is not transparent to you. In fact, with better music, often enough (it is a truism), if you're not totally familiar with the composer, the sections that you'll like most in the long run will be those which are hardest for you to appreciate upon the first hearing. I would argue that, with my recent films there is this quality: if you see a film again and again you will discover more structure. It will become more revealed to you that the whole work is a structure possessing its own kind of pattern integrity. It is unfortunate that our film viewing conventions do not permit the repetition we allow with music."

As advanced and sophisticated as Whitney's theories and films are, he clearly perceives that his art is, in many ways, still in an embryonic stage. He asks: "What if eight tones of the musical scale hadn't been discovered yet? What if our composers had only four tones to work with? And . . . what if the pianist had to wait twelve hours before he could hear the keys he had played? And, on the other hand, what if we could buy and play in our home these new visual compositions as freely as we play music recordings? Probably we will soon. And I expect we'll soon find the missing notes."

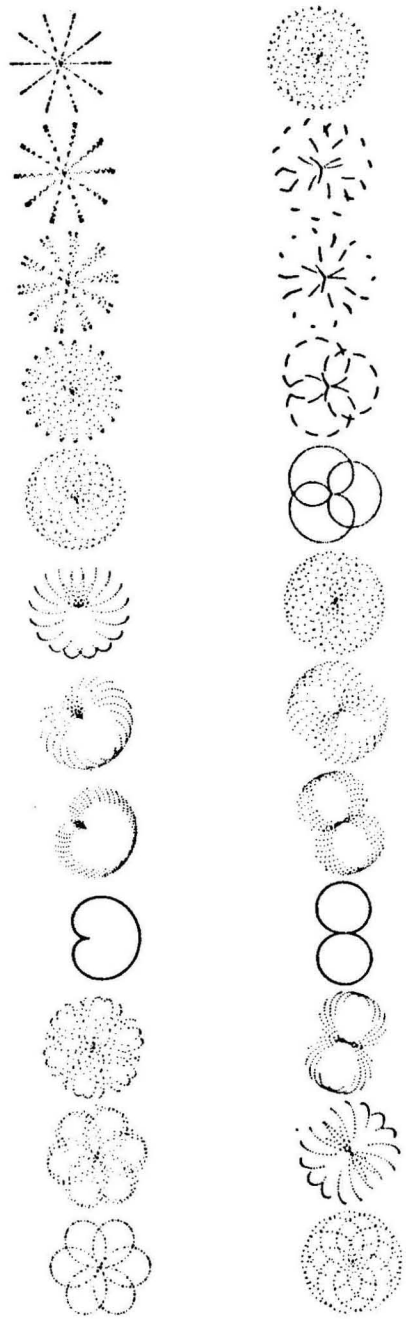


Figure 7. Selected here are some frames from the film *Permutations*. They might represent a much longer time sequence; being each one only the twenty-fourth frame, or one sampling every second of time. The order-disorder dynamics are explicit.

This sequence could as well be a schematized illustration of a melodic figure of music. (Read top to bottom.) Used by permission of John Whitney.