THE IMPORTANCE OF *FANTASIA* IN FILM AUDIO HISTORY

Disney's *Fantasia*

Walt Disney continued his innovation in film and audio techniques with the landmark production of *Fantasia*. Starring Mickey Mouse (along with many other animated characters), *Fantasia* choreographed animation to classical music. To facilitate a truly immersive experience, the Disney technicians came up with many new methods and equipment for recording sound. Multi-track recording was used for the first time to capture an orchestra and then overdub additional instruments, creating a many-layered soundtrack. John Volkmann, the recording engineer for *Fantasia*, used eight optical recorders to capture the orchestra—six machines recorded different sections of the orchestra, a distant microphone on the seventh and the eighth recorder captured a balanced mix of the whole orchestra. This method gave Volkmann the ability to recombine the levels of each section in the orchestra or even re-record or overdub them if need be. Later, a ninth click track was added as a guide for animators to follow. Cues could be given as to what action should be taking place, and the animators would have accurate timing down to each frame of film. The forty-two days it took to record the music for *Fantasia* used nearly half a million feet of sound film!

As there was no such thing as time code or electronic synchronization in the 1930s, a different, mechanical method was used to synchronize the nine optical recorders. The same sprockets that insert into the holes on the edges of film in order to keep it positioned and running at the correct speed could be linked mechanically between machines in order to synchronize them physically, as seen in the Moviola machine in Figure 1.2. Once the sound film has been placed on the machine and aligned to the sprockets, it would stay in sync with the other optical recorders connected to it. This way, many machines could be linked to create as large a tape machine as needed. This type of synchronization is still used in the film industry today, although digital technology such as Pro Tools is rapidly taking over.

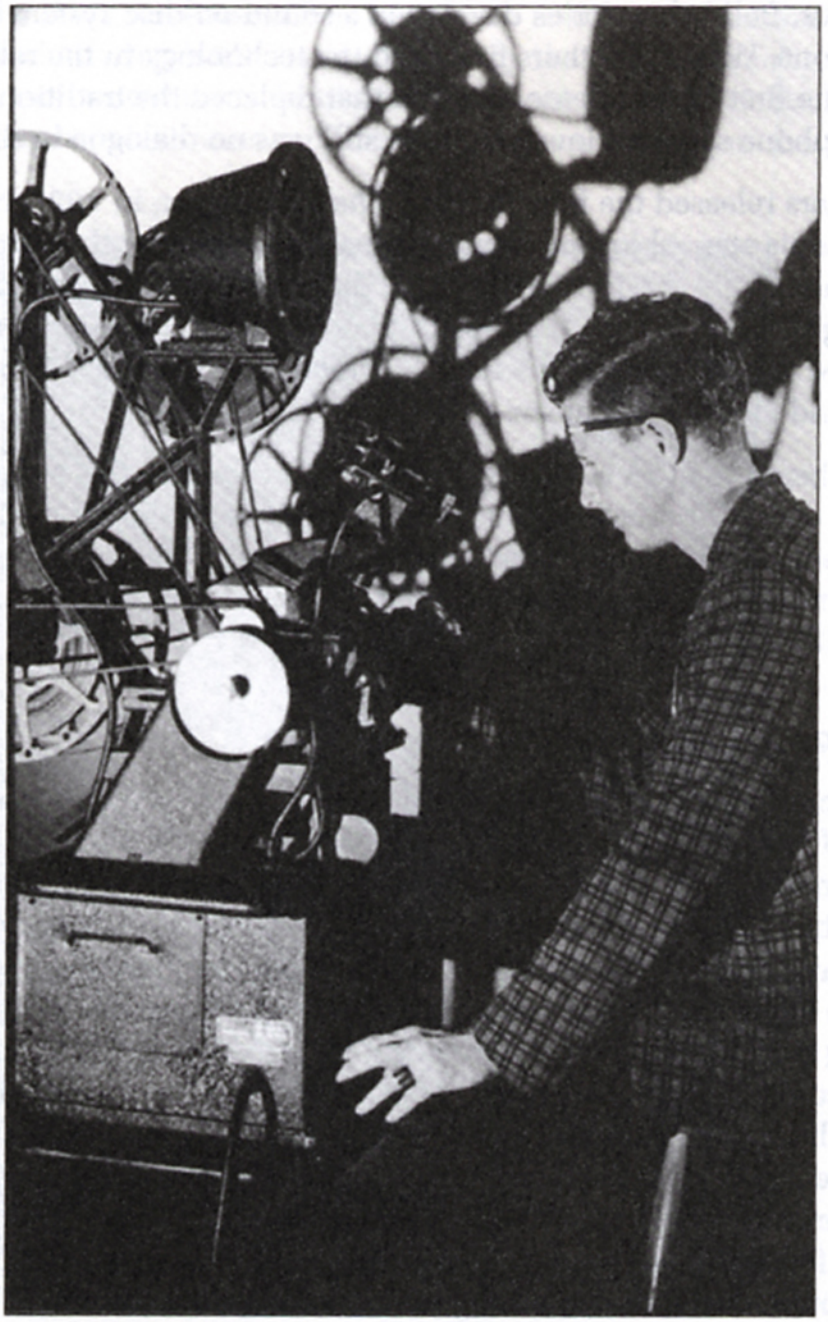


Figure 1.2
A very early film-editing machine called a Moviola. This type of machine is still in use today, although it is rapidly being replaced by non-linear digital editing systems.

A special playback system called Fantasound was invented specifically for *Fantasia*. The system employed two projectors. The first projector had the visual images on it, as well as a mono mix of the entire soundtrack as a backup. The film in the second projector, which was mechanically synchronized to the first, was printed with four mono optical tracks similar to the modern stereo optical track shown in Figure 1.3. Track one had control information, in the form of various frequency tones and amplitudes that were used to modulate the volumes of certain speakers during the show. Tracks two, three, and four contained the audio for the screen left, screen right, and screen center speakers, respectively. In addition, there were three other sources—called house left, house right, and house center—placed behind the audience. These channels were derived from the screen left and right channels and were modulated by the control track as well. Thus, the first surround-sound system was born.

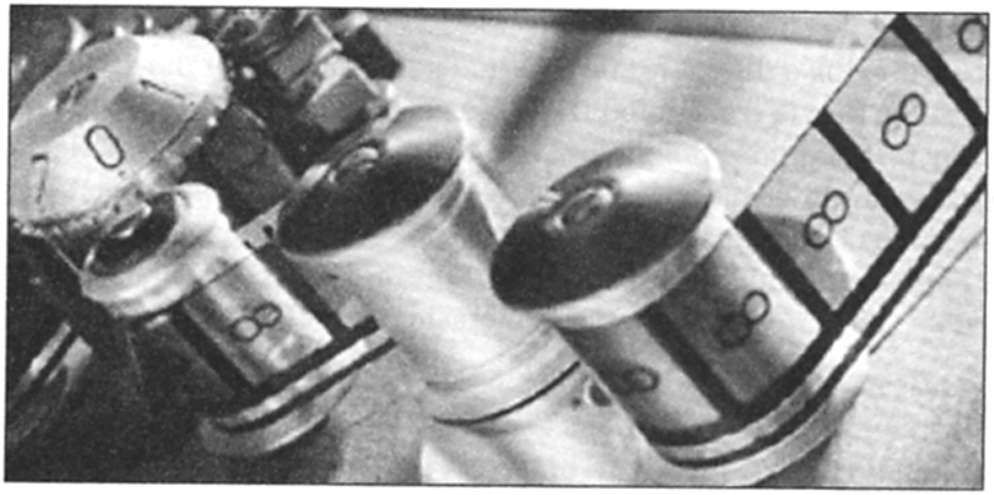


Figure 1.3
A piece of modern film showing the stereo optical tracks at the edge of the film. Notice how holes in the film go over the sprockets, helping to align and synchronize the motion of the film through the projector.

As the optical recording process did not offer much in the way of dynamic range, each signal was recorded as hot as possible, in order to reduce the noise level during playback. To achieve the dynamics needed by the film's orchestra conductor, Leopold Stokowski, the control track was implemented to vary the output levels to each speaker in accordance with the dynamics specified using voltage-gain amplifiers. This was a very early form of noise reduction. Today, technology such as Dolby SR provides noise reduction in more sophisticated ways.

William Garity, chief engineer for Disney at the time *Fantasia* was being made, was charged with creating a device that would simulate motion of a sound source back and forth across the screen. He theorized that fading levels between two speakers would create the desired effect. With that in mind, he designed a three-way differential circuit that allowed mixing down to a three-track master. The device was dubbed "The Panpot." It required six people, conducted by Stokowski, to operate all the panpots and adjust the levels while mixing the film. Stokowski had all the level and pan markings in his score, and he conducted the mixdown session as a film scoring session would be done today. As the VU meter had not yet been invented, a special three-color oscilloscope was used to maintain the proper recording levels.

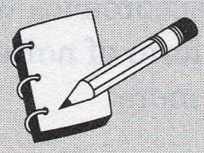
Fantasia's 54-speaker system was so expensive that only two were ever installed in theaters, one in New York's Broadway Theater and the other in the Carthy Theater in Los Angeles, at a cost of $85,000 each. The premier showing of *Fantasia*, on November 13, 1940, did not use a complete Fantasound system. Because of certain technical factors, a live sound engineer mixed the surround speakers during the screening. The Fantasound system was used only during the final "Ave Maria" sequence, and, for the first time, an audience was wrapped in 360-degree sound.

Due to the high cost of the Fantasound system, a smaller version was created that could travel around the country. It filled up half a freight car and weighed 15,000 pounds. It was called "Fantasia Road Show" and was used in only 14 theaters during the tour.

Fantasia has been re-released in various formats five times in the last 50 years. The first re-release, in 1942, had a mono mix and was edited down by 43 minutes. In 1956, *Fantasia* was

released in its entirety with a four-track magnetic format. In 1982, the soundtrack was re-recorded using a digital format. Although the fidelity of the 1982 recording is better, many fans of the movie considered the performance to be inferior to the original. So, in 1990, Disney restored both the picture and the soundtrack from the original masters. Since the optical recordings had been lost, the 1956 magnetic masters were used. Months were spent researching the original notes about the mix before Disney's Terry Porter was able to re-create the Fantasound mix for the modern 70mm Dolby six-channel surround format seen in theaters. This mix was also used to create the DVD master of the film.

Fantasia must be considered the most important film with respect to technical achievement in film sound. The innovations generated by its creation have fathered many of the techniques still used today in one form or another. It was an amazing accomplishment in animation, audio technology, and entertainment. Its high quality and creative value are still evident today.



INNOVATIONS IN THE CREATION OF "FANTASIA"

1. Multi-track recording using synchronized optical recorders
2. Overdubbing of different parts by the orchestra
3. Click track used by conductor and animators to choreograph animation and audio mixdown
4. Multi-channel surround playback system
5. "Panpot" used to move sounds across the screen
6. Control track on film used to regenerate dynamics from optical recording—*i.e.*, noise reduction
7. Use of oscilloscope to monitor recording levels—predecessor to the VU meter.