Sound Design for the Moving Image

The Development of Sound Design

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Introduction

The role of sound in cinema has often been underappreciated. Although the Oscars had an award for sound as far back as 1930, it wasn't until 1963 that an award for Best Sound Editing was added, and it was as late the 1970s that the term "sound designer" is said to have been coined by Walter Murch.[1] This paper outlines the development of sound design for the moving image by looking at two key aspects: the work of Jimmy MacDonald of Disney, and the construction of a 'timeline' of the development of sound design from 1893 to the present day.

Historical Analysis – Jimmy MacDonald

An example of how the importance of sounds in a film was historically often overlooked is that despite being responsible for some of the most well-known and recognisable sounds in cinema between 1934 and 1977, the Disney sounds effects artist Jimmy MacDonald is not credited on many of the films he worked on.

MacDonald moved with his parents to the US from the UK at the age of six months old in 1906. He grew up in Philadelphia, becoming a jobbing drummer in jazz bands in the 1920s. After working on steamships he moved to Hollywood, gaining a job as an engineer for the Burbank company. He continued to play drums and was hired by the Disney Company to play drums on a cartoon. Following the recording Walt Disney asked him to stay on with the company, and in 1934 he joined to start creating the Disney sounds-effects department. He became head of the department and it is said his combination of being a musician and an entertainer made him particularly suited to the role.[2] He worked for 42 years at Disney, on films, television and theme park attractions, and following his retirement continued to do session work for the company well into his seventies.

Before looking at some of his methods and techniques, it is instructive to understand some more about the Disney Company at the time, in particular the importance of sound to their cartoons. This helps understand his relationship with, and importance to, the company.

Disney and Sound

Walt Disney founded the Walt Disney Company in 1923 after experimenting with other animation ventures, and established a method of working that was almost like a factory production line in terms of efficiency and output. Indeed, it has been called "a classically Fordian chain of film production"[3] and that "Disney's magic and fantasy [were] deliberately manufactured."[4]

Disney very quickly realised the potential importance of sound to films and went on to use music, effects and voices to great effect. Byrne and McQuillan (1999) have said:

"Disney's films have always incorporated songs as a formal component of the text. Much of the cultural capital of Disney has been based upon the mnemonic quality of this music."[5]

Similarly, when referring to their early years, Wasko (2001) says that:

"Never one of the major studios [...] the Disney brothers built a reputation for quality animation utilizing cutting edge technological developments such as sound and color."[6]

Even in 1939, Jacobs was describing Disney as:

"The first of the sight-sound-color virtuosos."[7]

The importance of sound to Disney's success is demonstrated by Steamboat Willie (1928), the first Mickey Mouse cartoon, which used synchronised sound for the first time. Steamboat Willie has been described by Finch (1999) as:

"[a cartoon] specifically for sound – a movie in which the on-screen action [...] would be carefully synchronised with a strongly rhythmic sound track, which featured both music and precisely timed sound effects."[8]

It has been said that Walt Disney added sound after viewing the first feature film with sound, the Jazz Singer, in 1927. However, others have argued that without sound he was not able to sell his cartoons because they were silent, and was therefore forced to add sound.[9] Whatever the truth, Steamboat Willie was a great success, and convinced Disney of the importance of sound.

Disney further developed this with the Silly Symphonies, produced between 1929 and 1939. These were shorter cartoons that experimented with images, music and sound effects to create specific emotions, rather than simply to support humour. Later, Disney would continue to experiment and invest in sound. For Fantasia (1940) for example, the first stereophonic sound was developed, termed "Fantasound", and special sound systems were installed in prestige US cinemas for $30,000 each.[10]

It was this company, with its heavy reliance on sound and a willingness to experiment, that MacDonald joined in 1934.

Jimmy MacDonald's Techniques and Methods

An important change regarding the use of sound and music in animation was made in 1929, when Disney decided to record the soundtrack of films before animation work began.[11] The animators were therefore able to work to the rhythms in the music for the first time. Prior to this, the musicians would play the music in one take while watching the film. This also included sound effects; these would be included on the score, and played by four or five "percussion men" at the same time as the soundtrack was recorded. The percussion men would use existing items they owned like slide whistles,

xylophone bells, and ratchets.[12] The studio did not actually own any objects for creating effects, hence why musicians and in particular percussionists were employed.

MacDonald was therefore able to work in a much more flexible way than his predecessors. This was also aided by technical advances that allowed recordings to be made separately before being brought together into one final effects and music soundtrack. As well as allowing MacDonald more flexibility, the technological improvements also allowed him to experiment, and manipulate recordings to achieve the desired effect, for example by playing sounds backwards, or at different speeds. He would also combine two or three sounds to see what effect they could produce.

An example of this is given by Johnston and Thomas (1995), describing the effect created by MacDonald for the film Little Wolves (1938). A sound was needed to recreate a tomato hitting a wolf's face. Macdonald tried a wet flannel; however it had "too much impact." A thrown spoonful of grease was too wet, and water was "too splashy". By combining all three together however, along with a sound from a device known as Razzberry, MacDonald was able to create a suitable effect.

Before a film was made, there could be up to three years of testing and experimenting. This was undertaken by Disney's own staff, rather than more expensive session artists and musicians. For the sounds, this experimenting was usually led by MacDonald. His skills as a musician, and experiences drumming for early cartoons, meant he was expert at synchronising the sounds to the action and the score for the final recording. In addition, his outgoing nature and entertaining skills meant he had the imagination to develop sound effects in unusual ways that were 'right' for the images. He was quoted as saying the effects artist must "feel" the sound, and it's said he often threw himself "violently" into the task.[13] He is quoted by Johnston and Thomas as saying:

"The sound man must think about what the sound is going to do for the picture; not just how it ought to sound."[14]

In 1970, for The Aristocats, the sound department needed the sound of one of the cats drowning. MacDonald said he would do it himself in one take; he submerged his chin in a bucket of water, and created drowning and gurgling sounds exactly in time with the action on the screen.

Another example of MacDonald's imagination and experimenting was the sound of Grumpy's organ in Snow White and the Seven Dwarfs (1937). MacDonald requested that anyone able to read music or play instruments gather together, along with the sound effects men. A total of thirty men proceeded to blow various bottles, jugs, and other home-made instruments, while MacDonald yodelled over the top. This unlikely combination produced the sound for the organ. [15]

The synchronising of animation and sound effects was extremely technical, and was described by Les Clark, one of Disney's nine original core animators, as follows:

"We could break down the sound effects so that every 8 frames we'd have an accent, or every 12 frames. And on that 12th drawing, say, we'd accent whatever was happening – a hit on the head or a footstep or whatever it would be, to synchronise to the sound effect or music."[16]

Having someone with MacDonald's musical background in charge of sound effects was of great importance in supporting tasks such as these. If the sound was particularly important for character or the story, MacDonald would provide the animators at an early stage with a recording of the sound he was going to use, to allow them to create the drawings. MacDonald also pioneered sound effects "sheet music"; these were notes on a music staff that represented each sound and its duration.

Use of Props

MacDonald was particularly known for building his own devices to generate sound effects. He had a workshop at the studios, and would construct various gadgets to produce the sounds he wanted.

As an example, for the sound of rain he lined the inside of a rotating drum with small nails. He put peas in the drum, and when it was rotated the peas hitting the nails produced the required sound.

Often the sound created might not be what was expected. For one film, the sounds of creaking at an old mill were required. MacDonald constructed a device using drum heads, buttons, string, a wheel to tighten it all, and a bow. When he played it, it actually sounded like a foghorn. Like all his sounds, it was therefore placed into the effects library for use at a future date.

At other times the sound required would be difficult to identify. Once, Disney required a sound effect for a spider web with dew on it. MacDonald constructed a suspended device made of Duralinium, which produced a shimmering, light sound. Walt Disney was so impressed he requested MacDonald construct another one that could be played like an instrument. For The Rescuers (1977), MacDonald was asked to create a sound for an "exhausted dragonfly." He created a drum to play, using brass tubing, an air hose, and a rubber membrane. This created a suitable buzzing sound, which was complimented by MacDonald making wheezing and panting sounds. This is an example of where his musical talents as well as his skills as an entertainer were combined.[17]

Watts, quoted in Wasko (2001) describes the style of 'classic Disney' as being light entertainment, with music, and humour (usually physical gags and slapstick.) He said that Disney:

"…animated the world – literally – by ascribing intentions, consciousness and emotion to living and inanimate objects alike."[18]

MacDonald's sound effects played a fundamental part in this process of bringing objects to life, and in creating effective physical jokes and slapstick. For some effects, simple solutions were found. The

sound of the seven dwarves' squeaky shoes was achieved by bending an old leather wallet, and a fire in Bambi by manipulating bamboo.

In addition to creating sound effects for films, MacDonald was asked to create sounds for attractions at both Disneyland and Walt Disney World. One ride required the sound of a giant magnet, an example of a sound effect for something that in real life does not make a sound. MacDonald held a heavy duty soldering iron operating at 60 MHz against a microphone. This produced a low rhythmic humming sound, which he combined with a demagnetiser for scissors and brushing cotton against a large cymbal. No human could hear the sound, but after MacDonald mixed it and experimented, it forced people to leave the sound booth feeling sick. The sound therefore had to be modified before being used on a ride at the theme parks. This type of work continued well after his official retirement; when he died aged 84 in 1991, he was working on sounds for a new Disney World ride.[19]

MacDonald was also a skilled voice actor, and took over as the voice of Mickey Mouse in 1946 because Walt Disney's voice had become too gravelly due to smoking. Colleagues said he always saw the voice work as a small part of his job however, and preferred to work on the sound effects. If film sound can be divided into voice, effects (synchronous and asynchronous) and music, MacDonald was most definitely more concerned with the first two, in particular synchronous sound effects.

Relationship with Key Sound Design Organisations

It is difficult to find any recorded relationship between MacDonald and organisations such as the Motion Pictures Editors Guild, the Motion Pictures Sound Editors, or the Sound Design Commission. This may be a reflection that in his early career MacDonald did not receive much recognition generally, and so would never have been seen as a leading figure in Hollywood organisations.

This lack of documented activity may also reflect the wider issues between the Disney organisation and trade bodies and unions. Walt Disney was known to have problems with unions, and as a Disney "company man" MacDonald may have been loath to be seen publically in connection with external organisations. During his early years at the company, when Hollywood underwent a wave of unionisation in the 1930s, workers at Disney began to express dissatisfaction at inconsistent wage structures and bonus payments, and a lack of screen credits. Disney formed The Federation of Screen Cartoonists as a company union in 1937, but in 1941 The Screen Cartoonists Guild began bargaining for staff, and filed formal charges with the National Labor Relations Board, accusing Disney of unfair practices, including supporting a company union. This lead to Disney firing some staff, and a nine week strike. This was settled by arbiters from the Labor Department, but from this point forward Walt Disney's strong conservative streak became more and more evident. It is perhaps unsurprising therefore that in such an atmosphere, and considering his subsequent long service, MacDonald does

not seem to be documented anywhere as having particularly strong associations with organisations external to Disney.
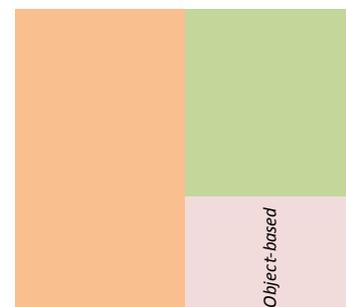
A Timeline of the Development of Sound Design from 1893 to Present Day

Year	Development	Key Texts	Dominant tech	Dominant dimension
1893	Edison demonstrates "Kinectophone" process - the first film with synchronised sound".		Acoustic	Mono
1894 or 1895		The "Dickson Experimental Sound Film" - made by Williams Dickson for Edison's Kinectophone. It's the first known film with sound recorded live.		
1898	Magnetic sound recording demonstrated by Poulsen with his "Telegraphone". It uses magnetic wire, which later on is replaced by magnetic tape.			
1906	Edison launches cylinders with two minutes playing time called "Grand Operas", but they are not a success.			
	A sound on film machine is patented by Eugene Lauste. It uses 35mm film with both images and sound strip.			
1917	Condenser microphone invented by Bell Laboratories.			
1921	"Phonofilm" is patented by Lee De Forest. It was a sound-on-film process, that photographically recorded the sound waves onto the film.	"Dream Street" directed by D W Griffith includes a sequence at the beginning where Griffith speaks to the audience. It uses the Photokinema system.		
1922	Optical sound systems introduced for film. Sound is recorded on the film by shining an electric light through a strip on the film's edge, creating a clear stripe of varying width.			
1926		"Don Juan" - Warner Brothers release first feature length film that has synchronised sound. Uses the AT&T "Vitaphone" system. It has effects and music, but no dialogue.	Electrical (Analogue)	
1927	Movietone News begins producing newsreels with sound.

"Vitaphone" system for film sound introduced. It is a sound-on-disc system i.e. uses a phonograph or other disc to record sound in synch with the film. | "The Jazz Singer" - Warner Brothers "Vitaphone" film, starring Al Jolsen. This is the first feature length film with synchronised dialogue.

Charles Lindburgh flight across the Atlantic is first news event filmed by Movietone with sound and pictures. It is shown in New York that night. | | |
1928		"The Singing Fool", Warner Brothers, starring Al Jolsen. Songs from the film become the first million-selling records of the talkies era.		
1930	The Academy Awards, which began in 1929, includes an award for Sound.			
1932	The Philadelphia Orchestra tests stereo recordings, using two microphones cutting grooves on one wax disc.			
1934	Telephone engineers demonstrate the effectiveness of surround sound in a cinema for the first time, using multiple microphones and speakers.			
1935	"Magnetophon" - German company AEG create the first reel-to-reel tape recorder.			
1937		Hindenburgh disaster captured on film. Sound from eyewitness radio report is later added to the film giving impression that pictures and sound were recorded together.		
1938	Directional microphone invented.			
1940	"Fantasound" developed by Disney, allowing films with multichannel sound.	"Fantasia" - the first commercial film with multichannel surround sound.		
1950	Open spool tape recorders become available in America.			

Year	Development	Film example
1953	"Cinemascope" introduced, including four channels of sound.	
1954	"Perspecta" sound introduced - simulates stereo by sending a mono signal to different channels at different times.	
1963	The Academy Awards include an award for Best Sound Editing.	
1965	Dolby Laboratories is founded.	
1974	"Sensurround" system uses highly amplified low-frequency rumbles to enhance cinema sounds.	"Earthquake" from Universal Pictures uses Sensurround.
1976	Dolby Surround Stereo is developed for analogue cinema systems. Dolby Pro Logic technology is used to decode it. First live digital recording of an orchestra made by Soundstream in Santa Fe, US. VHS home video system introduced, originally with a single audio track.	
1977		"Star Wars" demonstrates potential of Dolby Stereo sound.
1978	LaserDisc launched - the first commercial optical disk storage system. Allowed audio to be stored in analogue or digital format, and in various surround sound formats. Dolby develop 5.1 surround sound for 70mm film.	"Superman" uses Dolby 5.1 sound.
1979		"Apocalypse Now" uses Dolby 5.1 sound.
1982	Compact Disc (CD) from Sony and Phillips becomes commercially available in Japan.	
1983	THX launched by Lucasfilm, creating a standard for audio reproduction systems in cinemas, home theatres etc.	"Return of the Jedi" is first film from Lucasfilm that uses THX to guarantee cinema sound meets the desired standard.
1987	Sony introduce Digital Audio Tape (DAT), a digital tape recording system.	
1990	The BBC introduce digital NICAM Stereo for television transmissions. Cinema Digital Sound 5.1 surround sound introduced by Kodak.	
1991	Pro Tools software and hardware launched by Digidesign. Used for audio production in tv, film and music.	
1992	Digital codecs allow transmission of high quality audio over ISDN.	
1993	DTS surround sound system introduced. The audio is not on the film but is on a separate CD synchronised to the film. Sony Dynamic Digital Sound introduced, with capability for 8 channels of sound.	
1995	DVD specification agreed.	
1996	The first DVD mastering suite in Europe opens in Holland.	
1999	Dolby Digital Surround EX adds additional rear channel to 5.1 surround sound.	Star Wars: Episode 1 - The Phantom Menace is the first film to use Surround EX

Electrical (Digital)

Stereo / Multichannel
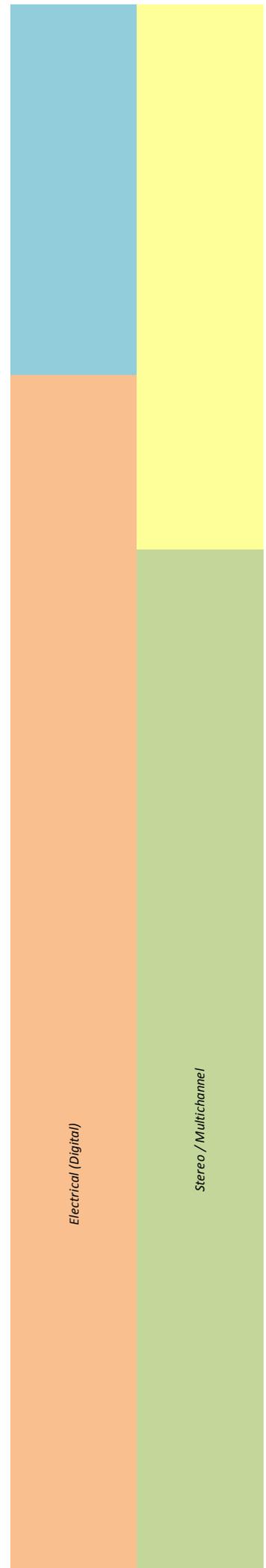
2010	Dolby Surround 7.1 launched, as digital distribution of films allows much more audio information to be stored.
2012	Barco Auro 11.1 system launched, with an extra 5 layers of height channels.
2012	Dolby Atmos system - allows filmmakers to specify exactly where in the cinema a sound should be heard. It is therefore an 'object-based' system.

Object-based

Sound Design in Videogames

In many ways the development of sound design for videogames is similar to that of films and television, in that developments in technology have allowed sound professionals to create ever more sophisticated music and effects.

Early video games included simple sound chips to produce mono, often looped sounds. Effects and music could only be very simple. By the early 1980s, improved sound chips allowed the first multichannel sound. Today, increased storage capacity and improved sound technology allows any sound or music to be played at any time, and often utilising technologies such as surround sound.

One difference between videogames and film is that videogames have the benefit of taking lessons from, and being influenced by, the century of learning from the world of film. An example of this can be seen in a scene in the Rockstar game Red Dead Redemption (2010) where the protagonist John Marston crosses into Mexico from the United States. The latest generation of so called "open-world" games probably demonstrate the state-of-the-art of videogame sound better than most genres, and yet this scene takes things one stage further than most games, showing even more the influence of film on video game sound.

All open-word games include synchronous sound effects to help flesh out the world, and many also include music for the same purpose. This is usually diagetic, such as a character listening to a radio in the Grand Theft Auto series of games. Where non-diagetic background music is used, it is normally in response to player actions, to add emotions such as tension, fear or excitement to the action. Such non-diagetic songs do not usually include lyrics; songs with lyrics are very seldom used in games, except for things like menu screens or non-playable cut-scenes. For the Mexican border scene in Read Dead Redemption however, Rockstar experimented even further with the medium, using a song in a manner much more like a film, while still allowing the player to retain some control.

At a set point in the game, the player is able to ride his horse across the Mexican border. When this happens the landscape changes into a much more open, sparse environment with large vistas all around. Shortly after, a song begins to play, "Far Away" by Jose Gonzalez. It is a relatively quiet, emotional, lilting song, quite different from the general feel of the game up to this point. The only other sound to be heard in this large open environment is that of the horse's hooves, and the overall effect can be to make the player feel quite lonely.

The playing of the song can cause some surprise in the player, as you are still in control of the character on the horse yet this seemingly unrelated song begins to play. This is so unusual in videogames that it can seem quite unsettling. Yet quickly it seems to fit the moment perfectly, as for once in a game you are not rushing to the next objective; you are being encouraged to pause, take a breath, and take in the environment.

To emphasis this further, the developers have given you no task or objective at this point. There is no 'game' element, so you are encouraged to just keep wandering around, taking in your new

surroundings, all the while listening to this slightly haunting, even beautiful song. And although you can move wherever you want, soon your movements on the horse subconsciously seem to match the mood created by the song and the visuals. It does not feel right to gallop the horse. In a film, or a traditional video-game cut scene, a similar scene would involve the hero looking around and the viewer / player just watching, which can be effective enough, but in Red Dead Redemption the effect is amplified by the fact you still have control of the character. By changing your behaviour from chasing the next objective to simply taking in the new surroundings, it creates a sense of immersion far stronger than many films. You *are* John Marston, and you *are* simply looking around, taking things in, slightly in awe of the new surroundings in which you find yourself.

The use of the song highlights one of the more difficult tasks facing open-world game developers compared to film directors. Once the Mexico area becomes available, the player is able to enter it to trigger the song at any time of day or night. The visuals may therefore be depicting daytime, night time, a sunset, a sunrise, or any time in-between. Despite this, the effect generated by the song would always seem to be the same. The tone of the song has clearly been chosen carefully, to work for whichever time of day the player chooses to enter Mexico; indeed it was written by Gonzalez specifically for the game.

The scene would seem to have had its intended effect. It has been variously described as a "revelatory experience", where "everything seems to coalesce into something calculated – and it's awesome."[20]. Others have said "it's so unlike anything we ever expect from a video game" and "It'll stop you dead in your tracks"[21], that it "had my spine-all-a-shivering", and is "extraordinarily special."[22]

The scene demonstrates how learning from the use of sound in films, combined with the added element of player interaction being guided to behave in a certain way, can elicit exceptional emotional responses.

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