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Sound Design for Film and Television

Seminar paper

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"Film sound is rarely appreciated for itself alone but functions largely as an enhancement of the visuals. By means of some mysterious perceptual alchemy, whatever virtues sound brings to film are largely perceived and appreciated by the audience in visual terms. The better the sound, the better is the image."

sound designer Walter Murch [8]

1. Introduction

Sound in film and television is meant to support the story of a narrative, documentary, or commercial film or television program. Sound may tell the story directly, or it may be used indirectly to enhance the story effects of the movie. Although there are separate perceptual mechanisms for sound and picture, the sound may be integrated by the audience along with the picture into a complete whole, without differentiation. In such a state, the sound and picture together can become greater than the sum of the parts. Thereby, sound for film is usually meant to integrate many elements together and not to draw specific attention to itself. The relative roles of picture and sound can change with regard to storytelling from scene to scene and moment to moment. In most instances, film and television sound is constructed in post production utilizing many pieces of sound, mixed seamlessly together to create a complete whole. This process is today known as sound design.

2. Development of sound design

Sound design is a technical creative field. It covers all non-compositional elements of a film, a play, a music performance or recording, computer game software or any other multimedia project. History of development of sound design in theatre is very long. Today is known that in India and China there were theatre productions, around 3000 BC, accompanied by music and sound [7]. The renaissance *comedia dell'arte*-style also used both music and sound effects, to make the theatrical pieces more ridicule. Possibly the first use of recorded sound in the modern theatre was a *phonograph* playing a baby's cry in a London theatre in 1890. It would not be, however, until the 1950s, when Hollywood directors started directing Broadway productions, that sound design would start growing. Still, there was no sound designer in those plays. It was the stage manager's duty to find the sound effects and an electrician played the recordings during performances.

Sound design in film is directly connected with the development of sound in film, and although this history is not so long as the history of sound design in theatre, it is actually film, who inaugurated the profession of sound designer and opened a new creative field for sound professionals. In the original film world meaning of the title, as established in the 1970's by Coppola and Walter Murch, a sound designer is an individual ultimately responsible for all aspects of a film's audio track, from the dialogue and sound effects recording, to the re-recording of the final track. The title was first granted by Coppola to Murch for his work on the film *Apocalypse Now* (1974), in recognition for his extraordinary contribution to that film [7].

From the inception of motion pictures, various inventors attempted to unite sight and sound through "talking" motion pictures. Nevertheless, sound with film as an idea seems to have started fourteen years before the invention of the motion picture, during the phonograph's infancy. It is known that the Edison Company experimented with this as early as the fall of 1894 under the supervision of W. K. L. Dickson with a film known today as *Dickson Experimental Sound Film*. In 1913, a different version of the Kinetophone was introduced to the public. But, due to the technical imperfection this early film-sound attempt caused the disapproval from the audience. For that reason the idea of sound movies was till 1915 almost totally abandoned. However, there still were quite number of the inventors, which continued with the experiments in this field. Thus in 1922, german inventors, Josef Engl and Hans Vogt, patented the "Tri Ergon" process, relied on the use of a photo-electric cell to transduce mechanical sound vibrations into electrical waveforms and then convert the electrical waveforms into light waves, optically recorded onto the edge of the film. The Fox Studio bought the patent in 1927, but their attempts were interrupted with the success of Warner Brothers, whose Vitaphone system was first embraced in August 1926, debuted the first sound film named *Don Juan*. It was the first mainstream film that replaced the traditional use of a live orchestra or organ for the soundtrack. However, in *Don Juan* there was no dialogue. The popular perception of film sound burst on the scene in 1927, with Warner Brothers' *Jazz Singer* starring Al Jolson. Although, originally conceived as a singing picture with no dialogue, Al Jolson ad-libbed some dialogue on the set and the "talkies" were born. Further, in 1928, *Lights of New York* was released by Warner Brothers as the first all-dialogue film. Although Disney's cartoon *Steamboat Willie* (1928) was the first film for which was completely created a soundtrack in post production including sound effects, music, and dialogue, it was considered the *King Kong* released in 1933 by RKO, was the first film that started sound design history. Murray Spivak, who did the sound design for the movie, was the first person to manipulate sound in a creative way¹. The next step was stereo

¹ Spivak used the sound of a lion's roar slowed down one octave mixed with the sound at unity pitch. It is the first use of design sound effect.

sound, reached 1935, when Alan Blumlein invented the first stereo variable area soundtrack. In 1940, Walt Disney's *Fantasia* was the first film to be accompanied with a multichannel format called Fantasound², which inaugurated quite a number of crucial innovations: the click track, dispersion-aligned loudspeaker system with skewed-horn, the pan-pot, control-track level-expansion, overdubbing of orchestral parts, simultaneous multitrack recording and the development of a multichannel surround system. After quite a range of inventions (cinerama, cinemascope etc) influenced with the development of television, the one of most important steps was inventing of the original professional Dolby A-type noise reduction, introduced in 1965.

From that time sound recording and reproducing systems are constantly developing and improving. Eventhough there have been more and more demands for top-quality sound, the profession of sound design is still struggling to obtain acceptance. Despite this continual, extraordinary advances in technology, the profession of sound designer was very late recognized as a creative field, not strictly based only on technique. The role of sound designer in creative process of filmmaking also wasn't clearly defined. Between 1980 and 1988, USITT's first Sound Design Commissioner oversaw efforts of their Sound Design Commission to define the duties, responsibilities, standards and procedures which might normally be expected of a theatre and film sound designer in North America [7]. Previously it was common to consider the sound professionals, which participated in sound design process as the part of the sound editing team. Today the term *sound editor* refers only to those who are working with already recorded sound material, and sound designers is the title used for the professionals who are participating in the sound recording (similar to the difference between director of photography and film editor). The role of *supervising sound editor*, or *sound supervisor*, developed in parallel with the role of sound designer is to be the head of the large sound department, with a staff of dozens of sound editors, required to realize a complete sound job for the movie. Sound designers, on the other hand, are expected to be creative, and their role is a generalization of the other creative department heads.

3. What makes film sound?

Sound plays a grammatical role in the process of filmmaking. It also provides a form of continuity or connective tissue for films. The basic two characteristics of sound in film, are:

² The Fantasound system employed two projectors. The first one projected the picture and had a mono optical mix of the entire soundtrack. This mono mix was used as a backup system in case of failure of the main soundtrack. A technique that is used in all of today's successful digital sound systems. The second projector was played in synchronization to the projector with the picture information. This second projector employed four mono optical sound tracks as follows: 1. control track; 2. screen left; 3. screen right; and 4. screen center.

- *hyper-reality* (Sound recordings for film and television are often an exaggeration of reality. Heard in isolation, the soundtracks seem overhyped, but heard in context, they assume a more natural balance. All these because of the fact that the single sounds in film often "melt" in auditory streams, and to be distinguished better, they should be additionally emphasized.)
- *correlation with a picture* (Sound often has an influence on picture. Scenes are different depending on how sound plays out in them. The sound also has a profound impact on storytelling, and on a film rhythm. The same scenes played without sound often seem much longer, than played with a background music.)

As already mentioned, there are two basic roles of sound in film. These are: *story telling* and *story supporting*. Story telling is the most important characteristic of the films in the "sound era", and is possible in film using dialogues, monologues or off-narration. Story supporting relates on the sound effects that enhance the tension in film and suggest the audience how to feel. Special sound effects and music are the basic tools which enable it. The sources for the sound used in film could be: recordings made during principal photography on sets, sound effects libraries and customized recordings, and music, both that composed from the film and from pre-existing sources.

The basic roles of sound in film are accomplished utilizing different *types of sound* in film, such as:

- speech (dialogue, monologue, over voice),
- music (recorded music, rerecorded music, live music, background music, etc.)
- sound effects
 - hard or "cut" effects
 - Foley sound effects (mixed with music)
 - ambience (backgrounds)
 - design sound effects

Speech is the most revolutionary thing which appeared in film history. It changed totally the visualisation of movies, which now differate very much from the films in the silent era. Today the speech is one of the most important tools for understanding the story of the film, so it is very important to be understandable and as more realistic, as it could be. Dialog editors depend on several sources for their tracks: *on set dialogue* (recorded during the film shooting, synchronous with the action), *wild lines dialogue* (dialogue lines that the actor records under the directors guidance, often at the end of a production day, in the same atmosphere of the set, after shooting).

These dialogues are often used later during the sound editing, for covering cuts, because they are of better quality.) and *synchronised dialogues* (recorded in postproduction for different purposes).

Music. At the beginning music in film was used for two very different purposes at once: to drown the noise of the projectors and to give emotional atmosphere. As cinema developed commercially, the music became more elaborate and played a larger and larger part in the show as a whole. There are quite a range of different appliance of music in the film according to its role in the movie. Music could be specially composed for the film, or could be used already made commercial music. The first step in the process of composing the music is that the composer, the director and the supervising sound editor or sound designer spot the picture. Spotting refers to going through the picture and noting where music should be present and what kind it should be. The particular problem is music editing, because it should be cut of to make the musical sence within the scene, and it is not always easy to achieve. One trick to accomplish music editing is to make cuts that will be masked by other soundon the sound track, in a case that inaudible cut is not possible to obtain.

The hard or cut effect. Almost every sound we hear at the movies that isn't dialogue or music is a sound effect. It is the expectation of the audience that everything we see on the screen, that in a real life makes noise, should be heard, and thus covere by a hard sound effect. Hard in this context means that the sound was obtained from a source other than a production sound, Foley, or ambience, and the sound was cut in by a sound-effects editor to match the picture. The hard effects are never recorded on the set, thus the basic sources of these effects are sound-effects libraries. It is common that sound designer doesn't record the library by himself, but uses all made commercial or private sound-effects libraries. In these libraries hard effects are organized according to their type into a variety of premixes. They could be grouped by event, for example, car door closing, start and drive away may be assigned to one premix, if tthat makes sense as a unit. The editing is performed so the premixes are organized to checkboard of sounds in time, making some of the combined effects at the premix stage first appear in one premix, and than in another. Combining sounds together to create new sound effects is a principle often used. Special manipulations may be done on either individual elements of a complete effect, or on the whole mixed effect. These include speed change, used to produce a corresponding pitch change, lengthening by mechanicalor electronic looping, and pitch shifting to make a sound seem to move past a point of observation, by faking Doppler shift.

Foley effects. Foley sound effects are those made in a recording studio called a *Foley stage*, while watching the picture a Foley artist performs the acting more or less synchronously with the picture (the perfect example of Foley effects are footsteps, who are always made with this sound effect). The Foley sound effects are the most responsible for realistic impression of the movies. However, they often exaggerate the real-life sounds to make them audible. Foley recording was invented early in the history of film sound by a man named Jacke Foley, working at the time at Universal Studios. Many early sound pictures had dialogue and music but no feeling of the noise of movement. Soon editors started cutting together footstep sounds for actors, but would use the same tracks over and over. Foley got the idea of projecting the moving image in a sound stage and recording sounds in sync with the actors' movements, using different surfaces and an array of props. The idea was that many sounds could be recorded to fit to the time they appear on the screen by simply performing the action in sync with the picture, and recording it. Today, Foley recording is likely to involve a multitrack recorder or workstation so that different record passes can be used to add layers or different effects, building up to a complete whole. However, it is not necessarily that Foley effects are recorded on the Foley stage. Sometimes, like in *Godfather II* (1974), sound designer Walter Murch had recorded them in spaces that duplicated the real space of the scene.

Ambience is the recording of background sounds present on the location or set. It gives artificial "presence" of the space. Ambience most typically consists of more or less continuous sound, often with a low-frequency emphasis associated with background noise of spaces. It plays a significant role in scene continuity. If ambience stays constant across the picture cut, the audience becomes the impression that the action stays in the same space. Conversely, if there is an ambience change at a picture change, the audience get the impression of the completely new scene. Ambience may even be overlapped across certain scene transitions, either to create an effect of the former scene lingering into a new one or to anticipate a cut to a new scene. One crucial spatial question about ambience is whether it should include sound in the surround channels during the reproduction. The difference between an ambience on the screen and ambience that includes surround sound is related to the degree of involvement of the audience. The use of surround sound creates greater involvement on the part of the listener by breaking the bounds of the rigid screen edges, and brings the audience into the action.

Design sound effects are sounds that do not normally occur in nature, or are impossible to record in nature. These sounds are used to suggest futuristic technology, or are used in a musical fashion to

create an emotional mood. These kind of sound effects were first inaugurated with the film King Kong (1933), and later developed in the field of SF film genre.

4. Fundamental techniques of sound design

The process of sound designing for film or television purposes usually consists of the four phases:

- recording,
- mixing
- synchronisation, and
- editing.

All these phases are very complex and deal with huge range of problems. That's why a whole team of sound professionals should be involved in sound design.

Recording. The general aim of the recording phase is to record every sound potentially useful in sound design processing and with the best possible quality. The quality of recordings depend in most part of the microphone type. Directivity of the microphone is also a particular problem to be solved. Using a more directional microphone generally leads to recording with a higher ratio of direct- to diffuse-sound field. The position of the microphones during the shooting of some scene is also a very important thing to be defined. The temptation in sound recording is to match the camera perspective for each new shot. In early sound recording there was an attempt to fit camera perspective, shot -by-shot to what was seen. A wide master shot was thus more reverberant than the associated coles-ups. Then, when the scene was cut together, there was a very noticeable change in the amount of reverberation. Modern practice thus most often uses relatively small changes in the microphone perspective to correspond to large picture changes and the reverberation changes are consequently kept fairly subtle.

Mixing. Production sound mixing involves microphone technique, recording, synchronisation, and has an impact of editing. Strictly technicaly speaking mixing is dynamically manipulating the level controls of the various microphones during the recording, taking for the purpose of emphasizing the desired sound, and the converse. In the modern practice, mixing phase is not strictly connected to the recording phase. Nevertheless, it became the basic part of the sound editing. The term mixed sound (or final mix) relates today on the completed soundtrack of the movie.

Synchronisation. Synchronisation today refers to the two basic terms. At the first place it refers on the technique which enables the picture and sound to be in the same phase and to "move" synchronously. The second meaning relates on the process of later recording of the dialogues and sound effects (Foley) in studios, which couldn't be recorded on the set with the appropriate quality. Even in the situations when the later recording of dialogues and sound effects were not needed, the synchronisation was necessary to avoid the problem which turned out during the process of making the film copies, which often caused the asynchrony between picture and sound. In today's practice these problems are overpassed with the new digital technology.

Editing is the final step of sound design, and results in getting the final mix (or the soundtrack) of the movie. During this phase all recorded sounds (speech, sound effects and music) are combined together to achieve the final "sound vision". To manipulate with the sound sound editors use a mixture of types cuts and transitions, to get the final mix. The cuts which could be used in sound editing are vertical or diagonal. *Vertical cut* means that the audio wave form is chopped off instantaneously and is used only in situation when the amplitude of sound is on the zero level. Vertical cut on any other non-matching level, will probably result in an audible click. *Diagonal cuts* are therefore favored for audio editing, with a typical crossfade time of one perforation on the film track, about 10 ms, and are used routinely when a smooth transition is needed. *Fading in* and *out* are just the basic transition between the sound units. Today is present the dozens of different editing effects which could be used for overpassing the discontinuity of sound in film.

5. Perception of sound as a tool of sound design

According to quite a number of psychological studies, there is a conceptual gap between the "sensation of sound" as perceptual experience and the recognition of sound as "event and meaning". In general, perception of sound, could be divided into the two categories: *objective* and *subjective*. The objective perception signifies the field of physical acoustics and relates on physical characteristics of the sound, its propagation, reverberation, and all other mechanisms which enable us to hear this natural phenomena. It also relates on the physical acoustics of the head, outer ears, ear canal, and so forth, interacting with sound fields. Human inner cognition and recognition of sound, which does not necessarily correspond to the physical characteristics of the sound, is domain of subjective perception, usually called psychoacoustics. Exactly that discrepancy between objective and subjective perception of sound, makes the creative field for sound design.

5.1. Auditory pattern of object perception

Important question of subjective perception of sound is auditory pattern of object perception. An auditory object is a sound that can be distinguished from the other sounds, and the basic question for psychoacoustics is how the listeners separate auditory objects from one another and from the background. The field of psychology, which dealt very much with a subjective perception of sound, is the Gestalt psychology. According to Gestaltists, humans usually separate the auditory objects by grouping them into figures and backgrounds. The mechanisms for creating that "vision of sound" are based on the following principles:

- *similarity* (Sounds are grouped together into one perceptual stream if they are similar in pitch, loudness, timbre and location.)
- *good continuation* (Smooth changes, with all constituent parts correlated with each other offer the impression of one whole. The abrupt changes usually indicate that the source must have changed.)
- *common fate* (If two components of sound undergo the same changes in time, they will be grouped together into an auditory object)
- *belongingness* (A single element can only form a part of one stream at a time.)
- *closure* (Thanks to the mechanism of masking frequencies, a continual sound interrupted with a much louder sound cover the discontinuity of the cut.)
- *attention streams* (Usually listeners pay attention only to one auditory stream at a time.)

Knowing of mechanisms, which support the human distinction of the auditory objects, enables sound designers to create the artificial soundtracks of the movies, which sound very realistic. Today is well known that the basic informations used to separate auditory objects are the following:

- timbre (spectrum change, onset transients)
- fundamental frequency
- correlated changes in amplitude or frequency
- location (Physical distance of the auditory objects determines our perception. If the we hear a set of sounds from a single location, we are likely to combine them into an auditory object.)
- contrast with previous sound
- time varying patterns (rhythm of sound should correspon with the rhythm of objects on the screen).

All these principles, and many more researched later, are used today in creating the film soundtracks, and "sound space" of the film.

5.2. Spatial perception of sound

Spatial perception is one of the areas where technology and art are most interrelated. The acoustic landscape in which we live is often revealed through the sound film [2]. Film and television sound systems are designed to provide the means to reproduce the most salient directional characteristics of the real world. The aesthetic difficulty comes in choosing what sounds to represent where, because the picture has boundaries, but the sound is unbounded in the same sense. Spatial perception has three dimensions: *horizontal*, *vertical* and *depth* [7]. Horizontal and vertical dimensions of localisation are usually accomplished with visual positioning of the sound source on the screen. In its third dimension, i.e. depth, perception is the most rough, since there is less information to distinguish sound distance than in the other dimensions. Still there are several mechanisms for hearing to obtain depth estimates. These include [10]:

- amplitude and brightness of the source (closer source is louder and brighter than a distant one),
- audibility of the ground reflection and how it changes with time out of doors,
- Doppler effect of moving objects,
- reverberation (longer reverberation time usually means larger spaces) etc.

5.3. Manipulation with spatial perception of sound

The basic creative field for sound design, as mentioned, is the manipulation with sound perception. The imperfection of human hearing and cognition of sound, sometimes, could be very serious constraints in the real world, but in the film they represent a huge advantage. The subtle associations and interrelations of thoughts and emotions can be conveyed by means of very low, soft sound effects. We hear sounds as events but at the same time many of the sounds we hear conjure up particular memories, associations and images of significant moments in the past. There is a particular kind of relationship between certain sounds we hear and their significance in our lives. Such emotional or intellectual linkages often play a decisive dramaturgical part. We have learned a language of sound imagery, where we simply seem to know what any given sound

"means". However, there is a considerable difference between our visual and acoustic education. One reason for this is that we often see without hearing (e.g. through a window), but we very rarely hear the sounds of nature and of life without seeing something, if not with the eyes then with the imagination.

One of the very often used phenomenon in the movies is the "*coctail party effect*" (or *binaural discrimination*) [6]. It describes the human ability to discriminate sounds better through the use of two ears rather than through recording. Standing at a party in reverberant space, with background music and many conversations going on, we are able to understand the conversation in which we are participating. If we replace ourselves with a microphone, make a recording of this situation and listen to it, we find that the recording is usually completely unintelligible. The fact that we can understand the conversation only when present is apparently caused by a number of factors:

- Spatial hearing allows us to concentrate on sound coming from one direction.
- Visual cues - during the process of hearing we usually use lip read to some extent.
- The participants in the conversation are likely to share a huge amount of background, restricting the range of possible topics and messages, filling in gaps in the conversation from the shared background and experience.

Knowing that mechanism of binaural discrimination works only with the human perception, and not with the technical devices, sound designers are forced to provide that effect artificially in postproduction, using the different sound layers.

Manipulation with sound perception often include a *frequency masking*. It is phenomenon that louder sounds cover up softer ones, especially those that are nearby in frequency. It is often used when it is necessary to achieve the continuity of sound (like in backgrounds) or to cover the in-perfect cuts in sound.

The fact that the depth dimension is perceptually the worst, makes it more useful for sophisticated manipulation by the sound designers. The subjective perception of depth depends also on the systems for sound reproduction. The new stereo systems offer two vital perceptual features that make it important to film and television sound: the ability to localize sound in various directions, and the ability to create enveloping, spacious sound having no particular direction, but reproducing recorded reverberation more correctly spatially than any monoural system can do. There are many examples of manipulation with the depth dimension of spatial perception, but for illustrating purposes here are just a few:

- *Making a voice-over narration less reverberant than on-screen action* - which in our perception gives the impression of a "voice of the authority", is used widely in

documentaries to give the effect of commentary of some objective observer, not necessarily involved in the action on the screen.

- *Making a voice-over narration more reverberant than on-screen action* - is the method for indicating that we are hearing the inside thoughts of a character.
- *Rerecording of sound in the "real" location* - gives the sound the roomlike character and makes it more realistic. An addition to this effect is to move the loudspeaker and microphone continuously while recording, making the sound constantly changing acoustical path.
- *Using of ton layers* - could be also one of the ways to accomplish a depth dimension. The impression of space we can get so that we fit the sound characteristics to the approximate "spatial position" of that sound on the screen. For instance, the first layer is the voice-over, which represents the space "in front" of the screen. Second is the foreground production sound, complete with the reverberations presented on the set. Next layer are off-screen effects, and the deepest part of the depth dimension is often scored with the music.

6. Conclusion

In a process of filmmaking, sound design is relatively young creative discipline, compared with applying sound design in theatre. That has perhaps impacted the fact that the responsibilities and duties of the acoustic professionals, who are working as a sound designers on film, are still not precise determined. Nevertheless the revolution of sound design happened exactly on the film. As a result, the film industry has devoted many of its resources to develop techniques for producing sound effects and ambience sounds that evoke emotional responses and allow the viewer to be immersed. The process of creating sound effects can be separated into two steps: the recording of the effects, and the processing. The basic tools of sound design are the imperfections of human cognition and perception of sounds.

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