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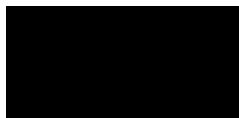
THESIS TITLE: Post Film, Let's Play: Sound, Design & the Digital Pipeline

DATE: 17 March 2018

Doctor of Philosophy Declaration (by Publication)

I, Kahra Scott-James declare that the PhD thesis by Publication entitled *Post Film Let's Play* is no more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This exegesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work”.

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## Abstract

The moving image creation process is *commonly* understood as having three distinct phases, preproduction, production and postproduction. Preproduction and production are largely focused on the image, while sound design is considered part of the postproduction phase. The absence of attention to sound in preproduction has a negative effect on postproduction, which can limit a film's distribution prospects, therefore a filmmaker's career opportunities.

Despite digital transformation, competition and the impact of economics, the convention of picture first and sound second is still the prevailing mode of production, especially in the case of independent film. Film is often described as a collaborative art form, however many filmmakers leave any serious consideration until postproduction, which is too late in the production cycle for any real collaboration. While rare, when film directors employ sound and image collaboratively the result tends to be innovative and successful films, however this is rarely discussed.

Historically, sound has been described as an add-on, an afterthought, therefore secondary to the picture. Film scholars continue to privilege the image. Film analysis favors image over sound, reception over production and theory over practice. Film is audio-visual, yet film education is visually-centric, an ongoing imbalance that stifles meaningful collaboration and hinders opportunities for re-thinking production processes.

Fundamentally there is a major imbalance between sound and image, across industry and education, particularly in early stage project development. Sound is an *afterthought* because sound design is considered something that happens *after* visuals in the production process. Once a film has been shot or animated, sound can only react to pictures, not interact.

## Methodology

Screen production research is a mode of enquiry that shares some features with arts research, but it is also distinct, which poses significant challenges. As has been argued, "there does not appear to be at this stage a distinct methodology sufficient to capture the complexities of the screen production enquiry process" (Kerrigan et al, 2015, p.8). Furthermore, sound for picture research presents additional challenges. Practice as an empirical form of research is common in fields such as design, but design like film, are typically addressed as visual art forms, sound is perceived as ephemeral and lacking a language. In design research the emphasis is on understanding the nature of practice and how to improve it rather than creating and reflecting on new artefacts. In contrast, in creative and new media arts the emphasis is on creative process and the works that are generated (Candy & Edmonds, 2018). The core research methodology is practice-led, in that it is concerned with the nature of practice to advance knowledge about the practice, in this case, sound design for moving image. As detailed by R. Lyle Skains (2018) in "Creative Practice as Research: Discourse on Methodology, Media Practice and Education," the results of practice-led research can be fully described in text form without the inclusion of a creative outcome. Where this research deviates, is in the discussion of creative works and processes through interviews with practitioners and the inclusion of creative works as ancillary artefacts, not the basis of research, as is more common in practice-based research.

In summary, research centres around the writing of a book, *Sound Design for Moving Image* and a series of moving image projects. The book is written to appeal to first and second year film and animation students, as a response to the ongoing neglect of sound in education. The creative work serves as a vehicle to further address this imbalance, and explore the use of audiovisual content to accompany text-based literature. The publication of *Sound Design for Moving Image* (Bloomsbury, UK, 2019), with content, is an attempt to help emerging filmmakers and animators explore reconfigure the working relationships they have in relation to sound design. I argue that a greater understanding of sound, its history and the practices that underpin sound design are crucial to addressing the

discrepancies between sound and image. Such an understanding can then lead to a more collaborative approach to workflow and processes. Furthermore, creative opportunities can be more fully explored and common postproduction problems circumvented if sound was more actively involved in the film creation process. The key question underpinning this research, and specific approach to research is, can a primarily text-based book help address the sound-image problem? In order to answer this question, I will be presenting a manuscript and sound design examples to provide insight into how the history and practice of sound in film can help students understand sound, and apply that understanding to their own work.

## **Preface**

Each chapter has corresponding creative support work, which is ancillary to the thesis, incorporated to illustrate how content could accompany text, and explore the type of content that would appeal to students, in reflection of the audiovisual nature of the subject area. The thesis is “by publication” and has resulted in the publication of a book.

Content can be located at:

<http://postfilmletsplay.wordpress.com>

Password: PFLP

Content can be viewed/listened to after each chapter. Chapters 1, 2 and 3 host pre-existing work selected for the book’s companion website. The film clips were selected to support concepts outlined in each chapter. As the work is older it has already been through the festival circuit and is in the public domain. Sound Designers do not own films, those rights pertain to Producers and Directors. Chapters 4, 5 and 6 host work undertaken during the duration of the PhD period. Each clip was selected to further illustrate the rationale behind the intention of this research.

## Table of Contents

<b>Motivation &amp; Aims .....</b>	<b>1</b>
<b>Contribution to Knowledge .....</b>	<b>6</b>
<b>Chapter Overview .....</b>	<b>12</b>
<b>Creative Work .....</b>	<b>13</b>
<b>INTRODUCTION .....</b>	<b>15</b>
<b>CHAPTER 1: EARLY PRACTICE.....</b>	<b>17</b>
<b>NOISES OFF - THE STAGING OF SOUND.....</b>	<b>17</b>
Stealing One's Thunder.....	18
Behind the Scenes .....	20
Puppetry, Slapstick, and Vaudeville .....	22
<b>THE PICTURESQUE OF SOUND .....</b>	<b>24</b>
Magic Lantern Shows, Installations, and Immersive Entertainment .....	24
Early Animated Films .....	26
Audiovisual Events and Installations .....	27
A New Art.....	29
<b>THE FALLACY OF SILENCE .....</b>	<b>30</b>
Phonography and Mechanical Mimicry .....	30
Live Film Soundtracks .....	32
Trap Drummers .....	35
<b>RADIO WITH PICTURES .....</b>	<b>38</b>
Mental Imagery .....	38
Sound Effect Artistry .....	40
<b>TRANSITIONING TO SOUND .....</b>	<b>45</b>
Amped and In Sync .....	45
Sound-on-Disc.....	46
Sound-on-Film .....	50
End of an Era.....	53
A New Form of Composition.....	55
<b>ANIMATION FINDS ITS VOICE .....</b>	<b>60</b>
The Thing That Hooked The Crowds .....	60
Incorporating Sound.....	61
Full Steam Ahead .....	63
Synchronized Dialogue, Silence, and SFX .....	65
<b>ADVANCING THE CRAFT .....</b>	<b>67</b>
Story, Design, Process, People.....	67
Sound, Story, and Workflow.....	69
Looney Tunes.....	74
Stop-Motion Film.....	77
<b>TV KILLS THE RADIO STAR.....</b>	<b>80</b>
Realism, Limited Animation, and Stylized Animation .....	80
Bang Bang.....	80
Limited Animation .....	83
Stylized Animation and Sound Effects .....	86
Graham – Micro Short (online).....	90

<b>CHAPTER 2: SOUND AS DESIGN .....</b>	<b>93</b>
<b>EXPERIMENTS IN DESIGN .....</b>	<b>93</b>
Short Films and Sonic Art .....	93
Sound Cards .....	94
Rated X .....	97
Now Hear This! .....	101
Mixing It Up .....	104
Aural Junk .....	107
<b>THE ART OF NOISE .....</b>	<b>113</b>
Sonic Sculpturing .....	113
Musique Concrète .....	113
A Manifesto .....	118
Sculptors of Sound .....	122
<b>FICTIONS OF SCIENCE .....</b>	<b>128</b>
Synthesis, new Waves, and Ambiguity .....	128
Film and Electronica .....	130
New Waves .....	135
Sonic-psychedelia .....	137
The Ambiguous Twilight Zone .....	140
Architects of Sound .....	145
Sleeper – Mixed Media Short (online) .....	152
<b>CHAPTER 3: CONTEMPORARY SOUND DESIGN .....</b>	<b>154</b>
<b>THE SOUNDTRACK .....</b>	<b>155</b>
Dialogue, Music, and Effects .....	155
Dialogue .....	156
Sound Effects .....	158
Sound Design Effects .....	158
Foley Effects .....	159
Atmosphere .....	159
Room Tone .....	160
Walla .....	160
Silence .....	161
Music .....	161
<b>THE SOUND DEPARTMENT .....</b>	<b>162</b>
The Supervising Sound Editor .....	163
The Sound Editor (Dialogue, ADR, Foley, Sound Effects, Music) .....	163
The Sound Designer .....	164
The Re-recording Mixer .....	164
<b>APPROACHES TO SOUND DESIGN .....</b>	<b>165</b>
Modes of Thinking .....	165
Real and Literal Sound .....	168
Hyperreal and Surreal Sound .....	169
Psychological and Emotive Sound .....	170
Metaphorical/Figurative Sound .....	170
Symbolic and Subliminal Sound .....	171
Design Duality—Audiovisual Synergy .....	175

T is for Talk – Horror Short (online) .....	178
<b>CHAPTER 4: PREPRODUCTION .....</b>	<b>180</b>
<b>THE DEVELOPMENT STAGE .....</b>	<b>180</b>
Genre and Style .....	182
Story and/or Theme(s).....	183
Story Development.....	184
Outlines and Treatments .....	185
<b>SOUND IN SCRIPT .....</b>	<b>187</b>
Scene Heading.....	189
Action .....	190
Character Name and Dialogue .....	191
Parenthetical.....	192
Transitions .....	193
Shots .....	193
Abbreviations .....	193
Montages and Series of Shots .....	194
Intercuts.....	195
Superimpose, Title, and Credits .....	195
Emphasis .....	195
Marking Up and SFX Lists .....	195
Script Breakdowns .....	198
<b>AUDIOVISUAL DEVELOPMENT .....</b>	<b>198</b>
Concept art .....	198
Storyboards .....	200
Shot Lists.....	201
Story Reels .....	202
Pre-Auralvis .....	202
Scratch Tracks.....	203
Temp Music .....	204
Research and Referencing.....	205
Creative Collaboration .....	210
Sound Design SFX & Textures (online) .....	233
<b>CHAPTER 5: PRODUCTION .....</b>	<b>235</b>
Capturing Sound.....	235
Digital Audio Fundamentals .....	236
<b>PRODUCTION SOUND.....</b>	<b>238</b>
Metering .....	239
Production Sound Mixer .....	240
Boom Operator.....	241
Utilities Person .....	241
On Location.....	241
Recording Dialogue for Animated Films .....	244
<b>RECORDING SOUND AND FOLEY EFFECTS .....</b>	<b>247</b>
SFX Lists.....	248
Transfer, Edit, Name, and Backup .....	248
<b>SOUND EFFECT LIBRARIES .....</b>	<b>248</b>

<b>STUDIO RECORDING .....</b>	<b>250</b>
Digital Audio Workstations (DAWs).....	251
Audio Interfaces .....	252
Control Surfaces.....	253
Plug-Ins .....	253
Monitors .....	253
Headphones .....	254
Video .....	254
Hard Drives .....	254
Transfer Formats .....	255
ADR .....	255
Performance and Direction .....	258
Foley and Sound Effects .....	261
<b>SOUND DESIGN EFFECTS.....</b>	<b>264</b>
Synthesizer and Samplers .....	265
Samplers and Sample-Based Synthesis.....	267
<b>DEVELOPMENT .....</b>	<b>269</b>
Spotting Sessions .....	269
Working with Animatics .....	270
Shorts to Features.....	270
Snow Country for Cold Elves – Short Film/48 Hours Film Competition (online).....	279
<b>CHAPTER 6: POSTPRODUCTION.....</b>	<b>282</b>
<b>SOUND AND PICTURE EDITING .....</b>	<b>282</b>
Editing Theories .....	284
Evolution of the Invisible Arts.....	286
Montage and Continuity.....	290
Creative Editing Techniques .....	293
VFX, Lighting, and Grading .....	302
<b>AUDIO POST .....</b>	<b>303</b>
Track Laying and Session Management .....	303
Groups, VCAs, and Auxiliaries .....	305
Stereo or Surround .....	306
Spatial Audio.....	307
<b>RE-RECORDING MIXING.....</b>	<b>307</b>
The Re-recording Mixer.....	308
Temporary Mixes .....	309
Premixing .....	309
The Final Mix.....	310
M&E Mixes.....	311
<b>MIXING TOOLS AND TECHNIQUES .....</b>	<b>311</b>
Dialogue Mixing .....	312
Effects Mixing.....	313
Music Mixing.....	313
Panning.....	314
EQ .....	315
Compressors and Limiters.....	315
Reverb .....	316

Monitoring the Mix .....	316
Mastering, Encoding, and Delivery .....	317
Common Mix Issues .....	318
Godplex – Feature Film (online).....	320
<b>CONCLUSIONS .....</b>	<b>322</b>
<b>Bibliography .....</b>	<b>326</b>
<b>Filmography .....</b>	<b>336</b>



## List of Figures

Fig 1:1 Various designs for thunder sound effect props. From DBS Publications, Inc. Drama Book Specialists, New York (1930) .....	19
Fig 1:2 Illustrations of common sound props. From Van Dyke Browne's Secrets of Scene Painting and Stage Effects, George Routledge and Sons, New York (1900) .....	21
Fig 1.3 A Slapstick. From <a href="http://coursesite.uhcl.edu/HSB/Whitec/terms/S/slapstick.htm">http://coursesite.uhcl.edu/HSB/Whitec/terms/S/slapstick.htm</a> .....	22
Fig 1:4 Promotional poster for Gertie the Dinosaur. From Winsor McCay: His Life and Art, John Canemaker, 2005 .....	24
Fig 1:5 Making sound effects at the Polytechnic in the mid-nineteenth century. From The Boys Playbook of Science (p. 306) London; George Routledge and Sons, Pepper, John Henry 1866 .....	26
Fig 1:6 Reynaud's Théâtre Optique, Musée Grévin in Paris 1892. From Le praxinoscope à projection d'Émile Reynaud pour La Nature, revue des sciences - 1882, n° 492, page 357. ....	27
Fig 1:7 The Eidophusikon (ca. 1782), painted by Edward Francis Burney. From the British Museum .....	30
Fig 1:8 Facsimile of an early Phonautograph tracing. From Jules Jamin, Edmond Bouty, Cours de physique de l'École Polytechnique, ed. 2, vol. 2, p. 629 (fig. 515) .....	31
Fig 1:9 Performing behind the screen, 1908. Courtesy of George Eastman House .....	33
Fig 1:10 An American effects setup. From New York Herald, April 17, 1910 .....	37
Fig 1:11 Lyman Howe's famous Ride on a Runaway Train (1921). From Educational Films Corporation of America .....	38
Fig 1:12 Sound effects chief Ora Nichols assisted by George McDonnell, at work on the CBS radio program The March of Time (1935). From Tower Radio, January 1935, p.24 .....	39
Fig 1:13 Sound effect artists in Back of the Mike (1938). From Jam Handy Organization (JHO) .....	43
Fig 1:14 Performing sound effects for The March of Time (1935). Promotional photograph released without copyright notice from Culver Pictures, Inc. ....	45
Fig 1:15 Kinetophone/Kinetoscope. From <a href="http://www.victorian-cinema.net/">http://www.victorian-cinema.net/</a> .....	47
Fig 1:16 The Chronophone. From Keystone-France, Getty Images .....	48
Fig 1: 17 First-nighters outside the Warners' Theater before the premiere of Don Juan (1926). From U.S. National Archives and Records Administration .....	50
Fig 1:18 Sound-on-disc, Warners Vitaphone. From ERPI, Warner Vitaphone .....	53
Fig 1:19 Finding His Voice. From Finding His Voice (1929, dir. Max Fleischer and F. Lyle Goldman), Western Electric Sound System, Inkwell Studios .....	55
Fig 1:20 Hitchcock and Anny Ondra on the set of Blackmail. From Magno, Contributor, Getty Images ....	56
Fig 1:21 M (1931, dir. Fritz Lang). From Nero-Film AG .....	57
Fig 1:22 The Triplets of Belleville (2003, dir. Sylvain Chomet). From Les Armateurs, Production Champion, Vivi Film .....	59
Fig 1:23 Dizzy Dishes (1930, dir. Dave Fleischer). From Fleischer Studios .....	62
Fig 1:24 Sinkin' in the Bathtub (1930, dir. Hugh Harman and Rudolf Ising). From Leon Schlesinger Studios .....	67
Fig 1:25 Fiddlesticks (1930, Ub Iwerks). From Celebrity Productions .....	68
Fig 1:26 Porky's Hare Hunt (1938, dir. Ben Hardaway & Cal Dalton). From Leon Schlesinger Studios ....	75
Fig 1:27 Fast and Furry-ous (1949, Chuck Jones). From Warner Bros. ....	77
Fig 1:28 King Kong (1933, dir. Merian C. Cooper and Ernest B. Schoedsack). From RKO Radio Pictures ..	79
Fig 1:29 James Arness as Matt Dillon in the television version of Gunsmoke (1956). From CBS Television .....	83
Fig 1:30 Crusader Rabbit (1949-57, dir. Alexander Anderson and Jay Ward). From Creston Studios, Jay Ward Productions, TV Spots .....	85
Fig 1:31 Space Barton (1950). From Telecomics .....	86
Fig 1:32 Colonel Bleep (1956-57, dir. Robert D. Buchanan and Jack Schleh). From Soundac .....	87
Fig 1:33 Gerald McBoing Boing (1950, dir. Robert Cannon). From United Productions of America [UPA]) .....	89
Fig 1:34 Graham (2008, dir. Paul James). ....	91
Fig 2:1 Ornament Sound Experiments (1932, dir. Oscar Fischinger) .....	94

Fig 2:2 The basic audio waveforms .....	96
Fig 2:3 Synchrony (1971, dir. Norman McLaren), National Film Board of Canada .....	97
Fig 2:4 The Tell-Tale Heart (1953, dir. Ted Parmelee), United Productions of America (UPA) .....	98
Fig 2:5 The Tell-Tale Heart (1953, dir. Ted Parmelee), United Productions of America (UPA) .....	101
Fig 2:6 Now Hear This (1962, dir. Chuck Jones and Maurice Noble), DePatie-Freleng Enterprises (DFE), Warner Bros. ....	103
Fig 2:7 The Last Trick of Mr. Schwarcewalldes and Mr. Edgar (1964, dir. Jan Švankmajer), Josef Soukup .....	105
Fig 2:8 A Game with Stones (1967, dir. Jan Švankmajer), Studio A See .....	106
Fig 2:9 Meat Love (1989, dir. Jan Švankmajer), Koninck Studios, MTV Productions, Nomad.....	107
Fig 2:10 The Grandmother (1970, dir. David Lynch), American Film Institute (AFI) .....	109
Fig 3:11 Eraserhead (1977, dir. David Lynch), American Film Institute (AFI), Libra Films .....	112
Fig 2:12 Pierre Schaeffer, INA, Contributor, Getty Images .....	115
Fig 2:13 ADSR envelope .....	116
Fig 2:14 Luigi Russolo, Dynamism of a Car (1912–13) © Luigi Russolo .....	119
Fig 2:15 Russolo's Intonarumori, Hulton Archive, Stringer, Getty Images .....	122
Fig 2:16 Pierre Henry, INA, Contributor, Getty Images .....	123
Fig 2:17 John Cage, Frans Schellekens, Contributor, Getty Images .....	125
Fig 2:18 Enthusiasm: Symphony of the Donbass (1931, dir. Dziga Vertov), Ukrainfilm .....	127
Fig 2:20 Bebe and Louis Barron, Walter Daran, Contributor, Getty Images .....	131
Fig 2:21 United Planets Cruiser from Forbidden Planet (1956, dir. Fred M. Wilcox), Metro-Goldwyn-Mayer (MGM) .....	133
Fig 2:22 Monster of Id from Forbidden Planet (1956, dir. Fred M. Wilcox), Metro-Goldwyn-Mayer (MGM) .....	135
Fig 2:23 La Jetée (1962, dir. Chris Marker), Argos Films, Radio-Télévision Française (RTF) .....	137
Fig 2:24 La Planète Sauvage (1973, dir. René Laloux), Argos Films, Les Films Armorial, Institut National de l'Audiovisuel (INA) .....	139
Fig 2:25 The factory in THX 1138 (1971, dir. George Lucas), American Zoetrope, Warner Bros. ....	142
Fig 2:26 The prison in THX 1138 (1971, dir. George Lucas), American Zoetrope, Warner Bros. ....	144
Fig 2:27 Surveillance center in THX 1138 (1971, dir. George Lucas), American Zoetrope, Warner Bros. ....	145
Fig 2:28 Apocalypse Now (1979, dir. Francis Ford Coppola), Zoetrope Studios, Zoetrope Studios.....	148
Fig 2:29 Sleeper (2008, dir. Craig Gladding) .....	152
Fig 3:1 The various elements of a soundtrack .....	155
Fig 3:2 Perspectives on sound.....	168
Fig 3:3 Varying approaches to sound design .....	172
Fig 3:4 Gravity (2013, dir. Alfonso Cuarón), Warner Bros., Esperanto Filmoj, Heyday Films .....	174
Fig 3:5 Raging Bull (1980, dir. Martin Scorsese), United Artists, REX, Shutterstock .....	175
Fig 3:6 T is for Talk (2011, dir. Peter Haynes).....	178
Fig 4:1 Fundamental considerations of sound design .....	182
Fig 4:2 Sin City (2005, dir. Frank Miller, Robert Rodriguez, Quentin Tarantino), Elizabeth Avellan, Frank Miller, Robert Rodriguez .....	183
Fig 4:3 Barton Fink (1991, dir. Joel Coen, Ethan Coen), Circle Films, Working Title Films .....	188
Fig 4:4 Panic Room (2002, dir. David Fincher), Columbia Pictures Corporation, Hofflund, Polone, Indelible Pictures .....	189
Fig 4:5 Coraline (2009, dir. Henry Selick), Focus Features, Laika Entertainment, Pandemonium .....	207
Fig 4:6 The Ring (2002, dir. Gore Verbinski), DreamWorks, Parkes+ .....	211
Fig 4:7 In the Cut (2003, dir. Jane Campion), Pathe Productions, Pathé Pictures International / Red Turtle .....	213
Fig 4:8 Rango (2011, dir. Gore Verbinski), Paramount Pictures, Nickelodeon Movies, Blind Wink Productions .....	216
Fig 4:9 Chico & Rita (2010, dir. Tono Errando, Javier Mariscal, Fernando Trueba), Isle of Man Film, CinemaNX, Estudio Mariscal .....	230

Fig 4:10 The Conversation (1974, dir. Francis Ford Coppola), Directors Company, The Coppola Company, American Zoetrope .....	231
Fig 4:11 Sound Design SFX & Textures .....	234
Fig 5:1 Fantastic Mr. Fox (2009, dir. Wes Anderson), Twentieth Century Fox Film Corporation, Indian Paintbrush, Regency Enterprises .....	245
Fig 5:2 Pro Tools Edit & Mix Windows, © 2017 Avid Technology, Inc. ....	252
Fig 5:3 DeEsser Plug-in, © 2017 Avid Technology, Inc. ....	258
Fig 5:4 VoiceQ, Kiwa Digital Ltd (www.voiceq.com) .....	260
Fig 5:5 Kontakt softsampler (Native Instruments) .....	268
Fig 5:6 Mary and Max (Elliot 2009), Adam Elliot Clayographies and Melodrama Pictures .....	278
Fig 5:7 Snow Country for Cold Elves (2007, dir. Ow & Maramara) .....	280
Fig 6:1 Intolerance: Love's Struggle throughout the Ages (1916, dir. D. W. Griffith), Triangle Film Corporation, Wark Producing .....	288
Fig 6:2 The Lord of the Rings: The Two Towers (2002, dir. Peter Jackson), New Line Cinema, WingNut Films .....	292
Fig 6:3 Delicatessen (1991, dir. Marc Caro, Jean- Pierre Jeunet), Constellation, Union Générale Cinématographique (UGC), Hachette Première .....	295
Fig 6:4 The Jacket (2005, dir. John Maybury), Mandalay Pictures, Warner Independent Pictures (WIP) Productions .....	297
Fig 6:5 Inception (2010, dir. Christopher Nolan), Warner Bros., Legendary Entertainment, Syncopy .....	300
Fig 6:6 The Shining (1980, dir. Stanley Kubrick), Warner Bros., Hawk Films, Peregrine .....	302
Fig 6:7 Godplex (2018, dir. Darcy Gladwin) .....	321

## **Motivation & Aims**

The book concept initially emerged from prior MFA research (Narrative Aesthetics - *Sound Design in Story Development: A Case for Pre-auralvis*, 2014), which looked at the lack of emphasis placed on sound during film pre-production. The research agenda resulted from spending 10 years working as a generalist across sound and picture, and 20 years specializing in sound-for-picture, working as a sound designer/re-recording mixer, alongside teaching, across 12 institutes in various countries. While conducting research it became apparent that the issues are complex and multifaceted; well beyond the scope of an MFA thesis. MFA conclusions are summarized as follows:

Despite an increasing awareness of sound design many filmmakers still neglect sound's potentials, particularly within early stage development. In later stages of production making picture changes is expensive, and the cost of audio postproduction prohibitive, especially for independent filmmakers. Further preproduction research will support the case for pre-auralvis and given the high costs of postproduction, prove beneficial. All preproduction materials are a form of pre-vis, however the process needs to include sound, and as a norm, not an exception. It is conceivable that the phasing out of celluloid film and the move to entirely digital workflows will impact on future production pipelines. On the other hand, traditional film conventions may merely be brought forward, and the notion of 'picture first, sound after' remains the dominant mode of production.

The key concerns for sound practitioners and students alike are poorly recorded location material, scheduling, budgets, workflow, photography/visual, edit, and mixes issues. These are inter-related. Re-recording mixing can only occur when the visual edit, VFX (visual effects), ADR (automatic dialogue replacement), sound design and music have been completed. Mixing involves blending and controlling the

various layers of the soundtrack. Since the late 1970's films have become increasingly complex in visual scale and detail, which means the process of designing and mixing film soundtracks is now more complicated. The mixing phase starts with pre-mixing dialogue, effects and music into stems. On some productions sound design is completed during the premix, or even the final mix, which further complicates the roles of sound designer and re-recording mixer. The impact of and differences between roles will be explained in subsequent chapters. Despite advancements in audio technology there is only so much information that can actually 'fit' into a soundtrack, so dialogue, sound effects and music regularly 'compete' for space. As an example, a dialogue driven scene will not benefit from music that employs common audio frequencies to the human voice. A poor-quality dialogue recording adds to the problem. If music is not lowered in the mix the music will 'mask' the voice and make it even more unintelligible. If the scene also requires a number of sound, or sound design effects, the problem is magnified. If the scene lacks emotion and the music is responsible for, or expected to bring emotion to a scene, the director will not want the music lowered in the mix. In addition, tighter production budgets are reducing schedules, which impacts on workflow. If there are problems with production material, picture or story issues, there is less time to 'fix it in the mix'. During the postproduction stage issues become apparent, but as sound comes after picture and audio budgets are often "tight", any problems arising during previous stages cut into audio post schedules and budgets. This problem has been exacerbated by the increase in low-to-no budget films being made.

In academia, film, animation and media scholars LoBrutto (2002), Beauchamp (2005), Michel Chion (1994, 2009), Rick Altman (1985, 1992), Jay Beck (2008), Helen Hanson (2007), and Gianluca Sergi (1998, 2004, 2005) have all raised the lack of impact of film sound research. An ongoing debate among scholars is the rigor of existing research and literature. It has been argued that the history of film sound is not well documented (Sergi 2005). Film sound history has concentrated on the 'silent era' and 'the talkies', and there is a lack of scholarship before and after these periods.

Chion (2009) has advocated for a more balanced and audio-visual understanding of cinema. Sergi (2005) has identified sound effects as an under examined subject and crucial to the understanding of audio-visual works. Chion (2009) observes, we do not have ear lids and aural training is not a part of our visual culture. Beck argues that the film production and postproduction process “perpetuates the idea of the dominance of image over sound” (Beck, 2008, p.73). Hanson has pointed out that “discussions of the production and meaning of sound effects, and the creative roles of sound personnel in producing them has remained relatively neglected (Hanson, 2007, p.27). As Sergi (2004) claims, there is an inability to step beyond image-biased film theory, and “the majority of scholars have by and large remained impervious to all things sound for nearly a century” (p.4). In animation, the soundtrack has taken a back seat to image in terms of resource allocation, even though “many experienced animators credit sound with as much as 70% of the success of a project” (Beauchamp, 2005, p.17). Areas defined as *especially* neglected by independent filmmakers are sound design and postproduction (LoBrutto, 2002). Altman states, “the image has been theorized, earlier, longer and more fully than sound” (Altman, 1992, p.171). Altman (1985) identifies a preoccupation with the coming of sound and claims “the concerns of the soundtrack have remained excluded from the nodal points of film criticism” (p.44). Issues surrounding film sound studies are well documented, however processes, workflows and the realities of contemporary production are not:

The current situation is so deeply rooted in decades of oversimplification and under-theorization about SFX [sound effects] ... it is difficult to imagine how the situation could be reversed for the present generation of men and women working in sound. (Sergi, 2005, para.35)

As a culture, we are visually-centric. We have a greater understanding and are more at ease with visual language, the notion of visual communication, and film as a visual art. While many DVD’s offer a “behind the scenes” look at the making of the visual

aspects of a film, and increasingly more focus on sound, it is rare to see/hear a film before/after audio postproduction, or much detail on sound processes involved in the making of a film. Producers, directors and studios do not want audiences to see/hear unfinished work, even test audience screenings are conducted with substantial sound design and re-recording mixing. Currently there is no set, defined or formal methodology for practical analysis of sound design in contemporary film soundtracks. Film soundtracks are ‘viewed’ as a composite whole; images fused with a deliberately transparent soundtrack. The audience watches a film without consciously listening to, or hearing the film. Film critics rarely discuss the aural aspect of a film, and film educators persist in describing film as a visual art:

“Visual media” is a colloquial expression used to designate things like TV, movies, photography, painting, and so on. But it is highly inexact and misleading. All the so-called visual media turn out, on closer inspection, to involve the other senses (especially touch and hearing). All media are, from the standpoint of sensory modality, “mixed media.” The obviousness of this raises two questions: (1) why do we persist in talking about some media as if they were exclusively visual? (Mitchell, 2005, p.395)

Sound technology has been widely discussed within academic discourse, whereas film sound design practice has received little attention. The focus on technology has resulted in the perception of sound as a purely technical discipline, “sound people get pigeonholed as being engineers, and technologists” (Thom, 2011, p.109). As Gary Rydstrom also argues, “the main attitude people have to change is that sound is a technical part” (Rydstrom in LoBrutto, 1994, p.245). In reality, the conceptual thinking that underpins sound design is similar to painting and sculpture; selecting and shaping the aural palette that will define the sound of a film. Painters do not operate brushes, and sculpture artists, however technical, are not perceived as technicians. Technology is a tool, and “superfluous without the concept that the

[production] designer is responsible for establishing” (Barnwell, 2004, p.119). Furthermore, a sound designer is defined as “the person who conceptualizes, executes, and supervises the sound for a film in the way that a production designer is responsible for the look of a film” (LoBrutto, 1994, p.286). The production designer is concerned with visualizing the script’s thematic, emotional and psychological concerns (Etteedgui, 1999). Sound designers shares the same concerns. Production design starts with pre-visualizing the script and translating it into visual images. The “look” of a film is developed through analysing the script scene by scene (Rea & Irving, 2015). Sound design can start with pre-visualizing the script and translating it into aural ‘images’. However, a production designer is involved in early stages of production, a sound designer is rarely involved in early stage development. This means there is little attention to, or articulation of sound until postproduction, which is when problems arise.

Audiences are more forgiving of image problems than they are of sound issues. In 2009, following complaints, the BBC launched a two-year study, which involved a 20,000-strong panel of TV viewers across age, geographical and social demographics. ‘Viewers’ were having problems hearing the dialogue in BBC content. Issues ranged from clarity in speech, to music being too loud. The BBC were surprised to find that most of the problems identified could be resolved if sound was considered in early stages of production (Cohen, 2011). Films with poor sound are unlikely to get selected for film festivals, which outside of the large budget feature film market, is where distribution deals are made. This impacts on the career advancement of everyone involved in the making of a film. Thousands of films are submitted to festivals and films with a high-quality soundtrack have a better chance of being selected. According to festival programmers like SXSW (South by Southwest Film Festival) head Janet Pierson, poor sound is a “deal breaker” for the SXSW programming team (O’Falt, 2015).



You can have funky images, it can be shaky, focus can be off,” said Pierson, “but the sound has to be of a quality that makes the film watchable. Veteran production sound mixer Thomas Varga (“Birdman,” “Blue Jasmine”) concurred, telling Indiewire that filmmakers focused purely on visuals fail to realize just how damaging poorly recorded dialogue can be. Poor sound has the ability to pull us out a story and performance, as much as it has the ability draw us in,” explained Varga. “Directors put a great deal of their energy into an actor’s performance, but I always tell them that performance means nothing if you can’t hear it clearly. (O’Falt, 2015, para.4)

In 2005, the Motion Picture Sound Editors (MPSE) organization presented their inaugural Filmmaker’s Award to George Lucas for outstanding contributions to the Art of Sound (Digital Content Producer, 2004). Lucas responded with his view that sound is 50% of the film experience. On his debut feature film *THX1138* (1971), Lucas edited pictures during the day while Walter Murch worked on the sound during the night. The resulting picture and sound combinations prompted both sound and picture editorial changes. Lucas did not sound design or mix the film, he recognized the value of sound design and sound-image collaboration. Murch identifies two key distinctions in direction as “whether you allow the process to become an active collaborator in the making of the film, or use it as a machine and try to restrict its contributions” (Murch in Ondaatje, 2002, p.217). As Randy Thom (1999) has (often) noted, specifically when discussing live action film production, why is it that in a supposedly collaborative medium, sound so rarely have the opportunity to exert any influence on the non-sound crafts?

### **Contribution to Knowledge**

Randy Thom (2011, 2015) has stated the most important sound advancements to be made are better communication with directors and early involvement. Scripts are the

start point for film production, yet the consideration of sound in script “is still something that’s quite alien to a lot of people” (Parker, 2003, p.184). Thom has urged the sound community to encourage directors and screenwriters to “design scenes and moments around immersive sound to take advantage of the sonic cinematic experience” (Thom in Giardina, 2014). Some writers think in sound terms, but it is not common and rarely taught in film writing courses (Thom, 1999). While there are some exceptions, most notable in animation production, script and sound design typically sit at opposite ends of the film production spectrum.

The migration to full digital processes is an opportunity to reconsider production pipelines, from script development and preproduction right through to distribution. In animation production, an animatic is produced by editing successive sections of a storyboard and adding sound. Storyboards are visual illustrations or images displayed in sequence, which help directors, cinematographers and animators visualize scenes. Storyboards look like a comic strip and indicate how a film will be seen through the perspective of a camera lens. The process was developed in the 1930’s by Walt Disney studios, and quickly become part of the preproduction phase for film production. Storyboards help limit expensive production, postproduction and visual effects work, which should extend to greater consideration of sound design and audio postproduction work across mediums. As storyboards and shooting scripts describe camera shot sizes (close up, medium, wide) and camera movement, they are valuable tools for identifying potential audio problems and aesthetic possibilities. While rarely acknowledged, the animation preproduction process has historically allowed for a higher degree of collaboration between sound and image than live action film:

Animated films begin basically as radio plays. Filmmakers use a sound recording of the actors’ voices as the starting point for the animation, and we’ll combine it with storyboards and more elaborate drawings. To make those very early experimental scenes work, they really need sound effects. In animation, you need to think about sound very early

on. This coincides with a soapbox I've been on for the past 20 years: Sound should be treated more like a full collaborator in the filmmaking. Sound ideas should be allowed to affect creative decisions in all the other crafts, starting in preproduction. That's one of the reasons I have enjoyed so much working in animation – in a way there's a clearer path to sound being a full collaborator. (Thom in Giardina, 2013, para.4)

Animation is redefining conventional film production processes. Pre-visualization processes have gained wider acceptance across the entertainment industries. Games are animation and 'live action' films frequently involve more CGI and animation than live footage. *Gravity* (Cuarón, 2013) for example, was made in a computer-simulated galaxy with computer-controlled machinery. In many scenes, the only element that is "real" is Sandra Bullock's face. The concept around 'pre-vis' is optimization of preproduction before production, or principal photography begins. 3D animation tools and virtual environments are used to create 3D assets, which block shots, camera moves and assist in establishing the look of a production (Saifi, 2011). The same concept should extend to sound design, regardless of whether a film is animation or live action. Collaborating earlier can isolate problems and opportunities for both picture and sound. At later stages the offline edit is complete and the picture is locked off. A locked off picture means the picture edit is finalized, which is to ensure timing is locked before an edit enters the audio postproduction phase. Any picture edit changes cause synchronization problems for sound. However, it is not uncommon for picture edits to change right up to and during the mixing phase. Given the cost of visual effects (VFX) it would also be economically beneficial to use sound design more widely within visual design processes. As Ben Burtt points out, "producers can put their money into special effects which can cost millions to get something great whereas in sound you only need to spend thousands or hundreds to get something great" (Burtt in LoBrutto, 1994, p.149). Sound Designer David Lewis Yewdall (1999, 2012), also refers to instances where visual artists informally dropped by and were

inspired by what he was doing with work-in-progress animatics. As a result, they revisited their visual designs in consideration of his corresponding work-in-progress sound designs. While “alternative” workflows, technology, creative opportunities and economic rationales for revisiting production processes exist, they are not a “norm”.

Post-vis is another evolving production process. Post-vis is similar to pre-vis, but occurs after production and generally on intensive visual effect (VFX) projects. The post-vis process reduces visual postproduction costs, which could also extend to audio postproduction. In addition to pre-vis and post-vis, pitch-vis is also starting to become a popular and potentially necessary method for testing ideas. Content creators can produce material that conveys the look and feel of a project for the purpose of securing production funding (Frazer, 2013, par.1). On *Gravity* Sound Designer Glenn Freemantle sound designed a 45-minute previsualization for studio executives. *Baby Driver* (Wright, 2017) was “auralized” for potential producers and executives through a read, songs and sound effects, effectively, “a 100-minute radio play that was the film without the pictures” (Machliss in Frazer, 2017). Again, rather than just consider the look and feel, why not use pitch-auralvis to conceive the sound of a film? In unpacking the opportunities that a renegotiation of sound-image relationship offers lies an additional opportunity, the podcast-to-television pipeline. Currently networks and streaming studios are purchasing the rights to audio-based narratives, or pod-casts to repurpose for the screen (Nevins, 2018). Again, why not use sound to conceive a film or television show?

In my current position as Assistant Professor, School of Cinematic Arts, DePaul University, Chicago, USA I teach two required sound design classes. These classes combined total 60 hours of sound design education. Across a 4-year film, animation, games degree program that is, at most, 4% of the program committed to sound design. Infrastructure, staffing, research and funding ratios follow suit, making sound design a difficult subject to effectively teach. Many film schools end the postproduction cycle with minimal focus on sound design and audio postproduction. Without experiencing

the full postproduction phase students do not understand how, or why the lack of focus on sound in preproduction impacts on postproduction. While there are film schools such as USC (University of Southern California), many film and media schools have a minimal focus on sound, and collaboration between sound and image, which means students do not have the opportunity to develop aural literacy.

The only way to evaluate or assess the contribution of sound to a soundtrack is firstly to understand what the soundtrack is, break it down to the individual elements, including non-dialogue and non-musical elements, and consciously listen, with and without images. To 'hear' the soundtrack and 'see' the audiovisual relationship, sound must become 'visible', which is difficult without undergoing some form of soundtrack "deconstruction". Chion claims a film gives the viewer/listener a feeling or sensation, but not necessarily a cause or associated signifier. When we 'hear' a film soundtrack, we are hearing many sounds together, which prevents locating an origin and "leads us to attribute to the image what actually comes from the sound-image combination" (Chion, 2009, p.208). This makes it challenging to ascertain the impact of sound on the image and image on sound. So, while sound augments the image, it is generally appreciated in visual terms, or as "added value". We see the pictures and associate the visual with meaning. Secondly, audiovisual analysis requires 'reverse engineering' a pre-existing film soundtrack, or through the process of creating an original film soundtrack; two presumably "technical" activities that are unlikely to be undertaken by film scholars.

Any discussion of sound design in film literature is marginal, particularly in introductory material for film students. A substantial gap exists. Walter Murch suggests aural literacy is still in its infancy; the long history of painting has shaped how we see the world, whereas with sound we are just at the beginning of a similar process (Murch in Shoard, 2013). Ben Burtt, Walter Murch, Gary Rydstrom and Randy Thom are among the very few industry sound designers that have written or spoken on the subject. Murch has referred to the influence of *musique concrete*, Burtt

and Rydstrom early sound pioneers working in film and animation, and Thom started out in radio. Despite this, the impact of musique concrete, animation, early sound pioneers and radio has never really been addressed in film or film sound literature. So, while it has been suggested the challenge for sound studies is to not only “cohere around their object of study but also to articulate cross-disciplinary methodologies and analytical approaches” (Beck, 2008, p.2), who is undertaking this work?

In addition to the literature problem, there are few sound-orientated academic journals, particularly those written in an accessible tone. Film sound design is a complex subject; it straddles art and science, has a century old history, is cross-disciplinary and combines three disciplines; film, sound and design. Sound and image collaboration results in highly successful and innovative films, but this is rarely discussed, which prevents any renegotiation of production processes. As stated, sound is an *afterthought* because sound design is considered something that happens *after* visuals in the production process. The key to understanding the sound problem in education, and therefore industry, is through greater engagement with the subject of sound design, sound practitioners and sound processes. A variety of literature covers dialogue and film music, but there is a notable shortage of sound design literature beyond trade and textbooks:

While there are often dedicated programs at the trade college level for sound engineers (who record and mix sound) or sound designers (who select and create sound effects for various media), courses on sound geared towards interdisciplinary or creativity-based majors at the university undergraduate level are rare. Although music has a considerable base of instructional literature available (indeed, there are many journals devoted to music education), the other auditory practice, sound (effects) design, is surprisingly underserved. Even within music or film composition courses, it is rare to have any instruction on non-musical sound. One of the potential reasons for this lack of curricular

consideration of sound is that there is little didactic material available in terms of instruction on sound design beyond trade books for practitioners or textbooks aimed at a very specific practice without any theoretical base. (Collins & Kapralos, 2014, para.3)

In summary, this thesis and associated film work forms the basis of a published book, which endeavors to address this imbalance and provide an insight into sound design, past and present. It is not an instructional text, technical or trade handbook. It adopts a more inter-disciplinary approach to the subject in an effort to raise awareness and highlight specific opportunities for the next generation of filmmakers. It aims to:

1. Create a greater awareness of options for emerging filmmakers, animators and sound designers to think innovatively, propose and execute more successful ways of working in a rapidly changing world
2. Encourage greater communication and collaboration between sound and image departments during preproduction and production
3. Prevent postproduction problems, for a more successful outcome.

### **Chapter Overview**

Chapter 1 looks at how the practice has been shaped by invention, innovation, and experimentation across theater, magic lantern shows, the first animated films, radio, and television drama, to the advent of sound on film. Chapter 2 considers the influence of experimental practices, the short film as a vehicle for alternative approaches to audiovisual storytelling, the impact of science fiction on sound design, and the establishment of sound design in the context of contemporary film. Also incorporated are various “readings” of films, particularly short films, as a vehicle to explore different approaches to soundtrack analysis, and relevance to intended demographic. Most film and animation students create short films as part of their study, and one of the aim of this publication is to encourage greater conceptualization and integration

of sound and image. Chapter 3 outlines what constitutes the soundtrack, the roles and responsibilities of the sound department, various ways of conceptualizing sound design. Chapter 4 looks at script and sound and early stage development as a vehicle for conceptualizing and planning for sound. Chapter 5 covers the basics of sound production, from recording and the creation of effects to working with story reels. Chapter 6 touches on sound and picture editing, the final mix, and how those stages influence preproduction and story development. Additionally, interviews with Director, Adam Elliot, Sound Designer, Peter Miller, and Foley Specialist, John Simpson have been included to further indicate the intent of the published text, which is to give students an insight to other practitioners.

### **Creative Work**

Each chapter has corresponding creative work which can be located at:

**<http://postfilmletsplay.wordpress.com>**

Chapter 1: *Graham* - Micro short film

Chapter 2: *Sleeper* – Live Action/Animated short film

Chapter 3: *T is for Talk* – Live action short film

Chapter 4: Sound Design SFX & Textures

Chapter 5: *Snow Country for Cold Elves* – Short Film, 48 Hours Film Competition

Chapter 6: *Godplex* – Feature Film

The rationale for producing and incorporating creative works as an addition to the thesis is support the writing, as an active practitioner, to further highlight the issues



surrounding soundtrack analysis, primarily the consumption of the soundtrack as a whole, and also as part of ongoing plan to develop original educational resources.

## INTRODUCTION

Since the advent of moving image, storytellers have used dialogue, sound effects, and music to accompany visuals. Sound design is by no means a new field; the practice has developed over time through various disciplines. The relationship between sound design and visual design is also a long-standing one. Prior to the advent of cinema, there were also many forms of time-based arts that incorporated sound. The first “sound” films and cartoons, however primitive by today’s standards, marked the beginning of a field that is continuously evolving. Sound is now a fundamental aspect of nearly every form of moving image based entertainment and media, from the inclusion of moving image into contemporary theater, audiovisual installations, broadcasting, film, animation, games, and virtual/augmented/mixed reality (VR/AR/MR).

Sound design is the capturing, generating, selecting and shaping of the aural palette that will define the sound of a moving image project. Contemporary sound design can be further defined as the creation of a single sound effect or sound design effect, and the design of an entire soundtrack. Current practice involves the recording, editing, generating, processing, and mixing of sound. Microphones and recorders are used to record sound, while synthesizers, samplers, and virtual instruments are used for generating sound. Processing (manipulation) is the intentional alteration of audio through the use of plug-ins and samplers. Digital audio work stations (DAWs) are used for studio recording, editing, layering, processing, and mixing sound. That’s the how to do, but what about the why and when to?

Sound, like image, can contribute to narrative development. Sound is perceived emotionally and aesthetically, as well as intellectually. Both sound and image are equally able to convey information, but it’s the combining of sounds and the interplay between sound and image that construct and determine meaning. While audiences do not consciously register what they are hearing when watching a film, they feel it,

which makes sound design a very powerful emotive device. Sound has the ability to evoke and *affect*. The abstraction involved in the creation of sound makes it a difficult subject to articulate and communicate. People have a greater understanding of and are culturally more at ease with visual language, the notion of visual communication, and film as a visual art. However, studies show that if the audio quality and design of a soundtrack are subpar, no matter how great the pictures are, audiences react negatively and are likely to dismiss or disengage from a film. While sound design has traditionally been perceived as a postproduction discipline, the consideration of sound starts in preproduction, with an idea and a script.

The book adopts a specific framework in order to help demystify sound design for moving image. It is not intended to serve as a sound engineering handbook, but as a guide for moving image content creators wanting to explore sound and collaborate with sound designers. The book version contains more production-based information, for the purposes of assisting students in their own projects, however this version focuses predominantly on the historical, conceptual and creative aspects of sound design, to support the key intention, which is to highlight the lack of literature concerning the non-technical dimensions of sound, past and present. The term “film” includes animated film unless stipulating a variation between animation and live action. While there are differences in film and animation production processes, the lines between live action, CGI (computer generated imagery), and animation are blurring. Regardless of medium, the same or similar concepts can be adopted, adapted, and applied to any project employing sound.

## CHAPTER 1: EARLY PRACTICE

It is difficult to pinpoint the exact birthplace of sound design for moving image. Walter Murch was the first to be officially credited as “sound designer” on *Apocalypse Now* (Coppola, 1979), however exploring sound as a design discipline predates the 1970’s. The history of early sound design is nonlinear, but nevertheless there are many parallels, lines, and interrelationships between audiovisual art forms that have informed sound design as a practice. Although the lineage is complex, and seemingly non-related, it is clear inventors and practitioners adopted and adapted ideas from one discipline into another. The first sound designers were primarily performance artists and concealed offstage, behind the screen, and later behind a microphone. While associated technologies have changed, many of the fundamental concepts and techniques developed prior to the 1970’s are still relevant today. Furthermore, developing an aural literacy necessitates understanding sound history and the many disciplines that have, and continue to inform sound design.

### NOISES OFF - THE STAGING OF SOUND

In theater, sound design works in the same way as set, lighting, and performance design; decisions are based on aesthetics, mood, and meaning. The first to be credited as a “theater sound designer” was David Collison (1959), Jan Man (1961) and the more-well known, Dan Dugan, who began his career as a lighting designer before migrating to sound design in 1968 (Slaton, 2019). Dugan introduced more complex and atmospheric soundscapes to theater, which led to the introduction of the new title. Another key figure in theater sound is Abe Jacob, who also advanced the concept of sound as a creative and designed element, particularly the use of sound to create mood and atmosphere (Rothstein, 2012). Theatre sound design is still considered one of the newest theatrical design fields, second only to the domains of projection and multimedia. However, the perception of sound as new design field is partly due to audiences being unaware of sound as a designed component (Kaye & Lebfecht,

2009). Today there is a growing interest in cinematic theater, which involves the integration of pre-produced moving image elements and sound design.

Despite the differences between theater and film, theater existed around the world long before moving image, and many of the techniques used in early theater sound design were adopted for moving image production. The use of sound effects in theatrical storytelling dates back to the Middle Ages and beyond. Theater in India and China during the Bronze Age (4000-2000 BC) was accompanied with sound and music. Techniques and devices developed for Medieval drama became common conventions in the theatre of the Italian and English Renaissance (Kaye & Lebrecht, 2009). Elizabethan theater (1562–1642) used sound effects (or “noises off”), which were performed backstage (or offstage) while musicians were housed in one of the balconies above the stage. Thunder runs (rolling cannon balls) were built into the ceiling and cannons were housed inside the roof to emulate the sounds of battle and thunder. Actors or voice artists mimicked everything from birds to the wailing of ghosts. The most frequently used sound effects were alarms, clocks, whistles, chimes, bells, thunder, storms, gunshots, cannons, wolves, crickets, owls, roosters, croaking toads, hounds, horses, armor, and swords. Most early theater productions involved the imitation of “natural” sounds by artificial or mechanical means; however, Kabuki, a form of traditional seventeenth-century Japanese theater, called for both literal and stylized sound effects. Drums, flutes, bells, and gongs were used to create textural sound effects and sound props for the more literal effects.

### **Stealing One’s Thunder**

One of the most common early theatrical sound effects was thunder, and it served three purposes, the *real* (thunder in the physical world), the *subconscious* (thunder as the sense of impending doom or danger), and the *supernatural* or the *unreal*. Nicola Sabbatini, an Italian architect of the Baroque and a pioneering inventor of set, lighting, and stage machinery, was among the first designers to create sophisticated

machines for audiovisual effects such as sea, storms, lightning, fire, hell, flying gods, clouds, and thunder. In 1683, Sabbatini published *Pratica di Fabricar Scene e Machine ne' Teatri* (*Manual for Constructing Scenes and Machines in the Theater*), which depicts an illustration for the thunder box. The design calls for thirty-pound (approximately 13.6-kilogram) iron or stone balls and a case of stairs. The balls rolling down the stairs simulated the “roll” of thunder and thunder “claps” as the balls fell onto the next step below. The individual design of thunder sound props was of some importance in early theater. In 1708, British theater critic and writer John Dennis designed the more controllable and realistic sounding thunder sheet for one of his new plays at Drury Lane Theatre in London. However, his play was not a success and management withdrew it. A later production of *Macbeth* at the Drury used the thunder sheet, which angered Dennis, and he accused the theater of stealing his thunder (Mott, 1993).

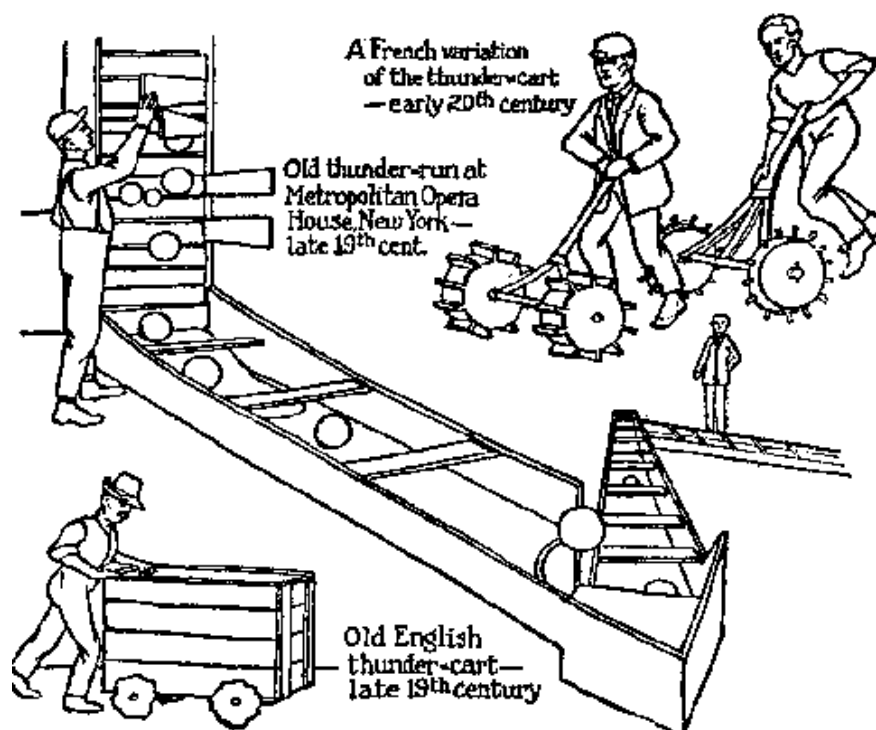


Fig 1:1 Various designs for thunder sound effect props. From DBS Publications, Inc.  
Drama Book Specialists, New York (1930)

### **Behind the Scenes**

Van Dyke Browne's *Secrets of Scene Painting and Stage Effects* (Browne, 1900) includes a section on sound effects offering an insight into early practices. Browne was a scene painter, but one of his “bug-bears” (things that annoyed him) was the lack of attention to sound in amateur theater productions. He illustrated his discontent by discussing specific scenarios such as the opening of a house window in a busy London street:

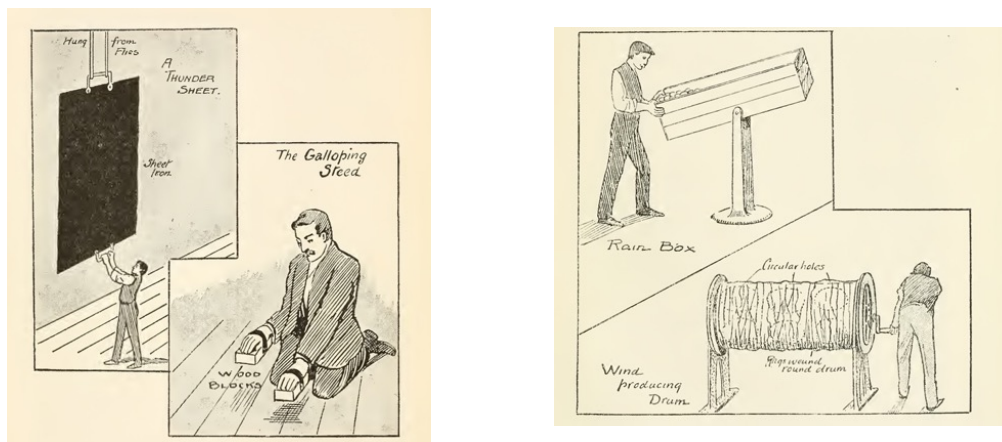
Thanks to motorcars the sound of traffic is easily produced on the stage. Two or three motor horns will produce some of the sounds with which people are familiar, but to get the right effect the men using the horns must retire from the window; indeed, one of the horns should be some distance from it in the first place. The only way to get this effect of distance is to stand in the auditorium and have the horns sounded from different places behind the scenes. (p. 65)

Browne was not just identifying the type of sound effects used to create a distant city atmosphere but also isolating a sound effect that is quick and easy for audiences to recognize and understand. Browne also pinpointed the need for considering perspective and the combining of sounds. It's unlikely and therefore unrealistic for a car to be too close to a window, and for a number of cars to be the exact same distance from a window. His suggestion of standing in the auditorium and listening (to the mix) was a way of checking that the balance of sounds was creating the intended outcome, a city atmosphere, from the perspective of the audience. Browne also discussed “horses off,” or what would now be described as the creation of Foley effects, in similar detail:

The sound of horses trotting up the imaginary road outside the imaginary house of stage-land is easily produced. The man whose

business it is to produce this sound has a couple of wooden blocks, each fitted with a short band of webbing, into which he slips his hands. The blocks are knocked on a board placed on the floor of the stage, and when the horses are supposed to be very near the scene the board is discarded, and the wooden blocks are knocked on a slab of slate or marble. Some men prefer to use cocoanut shells instead of the blocks of wood; the shells, which must be cut or ground flat, give a better ring to the sound. (p. 65)

Browne was again identifying perspective, and in combination with the choice of contact materials, to create the right sound, within the context of perspective. Materials like slate and marble will generally produce a higher pitched and therefore closer perspective sounding sound than a material like wood. Wood contacting wood does not give a realistic rendering of horses trotting on a road; a road is usually concrete, asphalt, paving, dirt, or gravel. Slate and marble surfaces are closer to concrete and paving. Browne also offered a preferable alternative to using wood blocks as hooves, which—as comical as the use of coconut shells always sounds—does sound more like horses trotting than the sound of wooden blocks.



*Fig 1:2 Illustrations of common sound props. From Van Dyke Browne's Secrets of Scene Painting and Stage Effects, George Routledge and Sons, New York (1900)*



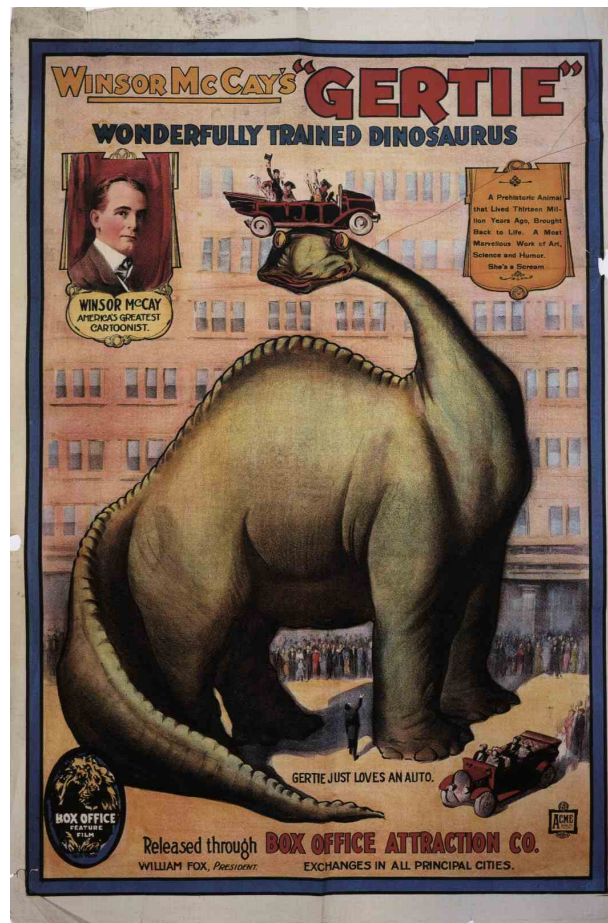
### **Puppetry, Slapstick, and Vaudeville**

Another common sound effect prop in early theatrical performances was the “slapstick,” a paddle-like device introduced by sixteenth-century *Commedia dell’arte* (“comedy of skills”) troupes, although it has also been traced right back to the theater performances of Plautus in the third century. *Commedia dell’arte* was an improvisational style of theater believed to originate from Italy. around 1545 but has been traced back eight centuries before the Common Era in Greece (Drake, 2013). Traveling companies of professional actors performed outdoors in public squares, using simple backdrops and props. The slapstick is two pieces of wood hinged together so when snapped a *slap, thwack, whack, shot, or whip crack* sound is created. Slapstick comedy, characterized by absurd situations and vigorous or violent action, became popular in vaudeville theater, and also in silent film with comedians such as Charlie Chaplin and Buster Keaton. The slapstick was also a common sound prop used in puppetry. The Punch and Judy puppet shows also had roots in the sixteenth-century Italian *Commedia dell’arte* and often included the slapstick. While very little is written about sound for the Punch and Judy shows, various illustrations suggest that dialogue, music, and other sound effect devices were also used in performances. Puppetry and hand shadows are thought to be one of the earliest forms of theatrical storytelling. Shadow puppetry originated during the Han Dynasty (121 BC), and shows were also staged with music and sound effects.



*Fig 1.3: A Slapstick. From <http://coursesite.uhcl.edu/HSH/Whitec/terms/S/slapstick.htm>*

Vaudeville theaters were among the first venues to screen early motion pictures during the late 1800s. Vaudeville shows usually featured eight to ten acts, which included magic lantern shows, puppetry, acrobatics, pantomime, performance, and film. During the early 1900s shows were even recorded, both image and sound, by a precursor to film sound systems, the Cameraphone (Altman & Hanzo, 1995). *Gertie the Dinosaur* (McCay, 1914), American cartoonist and pioneer animator Winsor McCay's third short film, was used as part of a vaudeville act that combined animation with a live "interactive" performance. McCay appeared onstage in front of the projection screen, and brandishing a whip ("crack") directed Gertie to perform tricks. In the film's finale, McCay disappeared behind the screen, reappearing in animated form and riding off on Gertie's back. The vaudeville version was later modified so that the film could also be played in regular movie theaters. The film version was prefaced with a live-action sequence and the live dialogue replaced with inter-titles, making it one of the earliest known mixed-media, multi-platform productions.



*Fig 1:4 Promotional poster for Gertie the Dinosaur. From Winsor McCay: His Life and Art, John Canemaker, 2005*

## THE PICTURESQUE OF SOUND

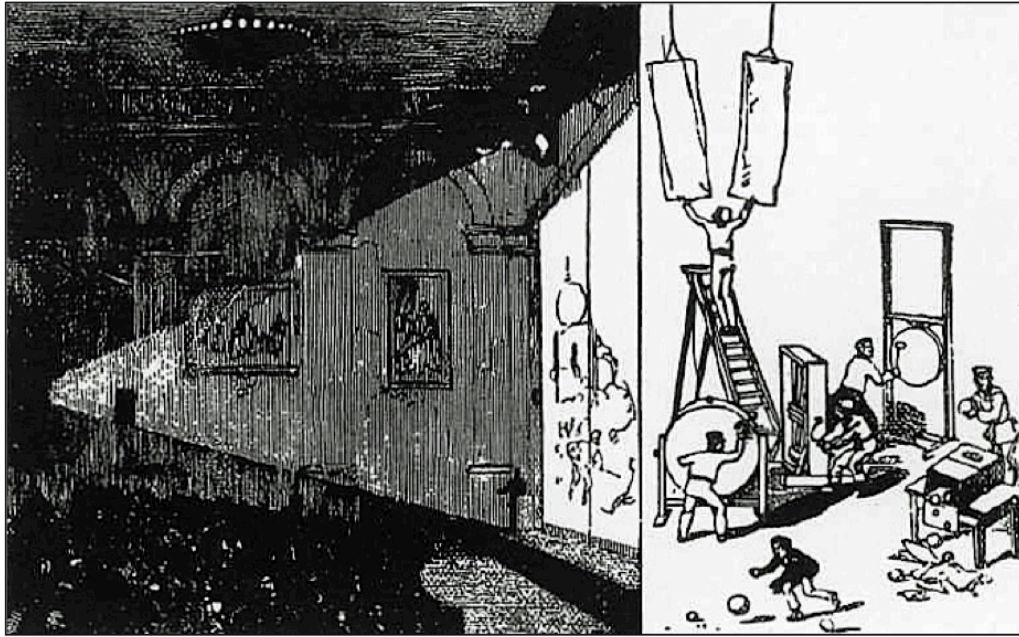
### **Magic Lantern Shows, Installations, and Immersive Entertainment**

The use of sound effects in moving image storytelling originated with magic lantern shows during the 1800s although the creation of the magic lantern has also been attributed to several people in the 1650s. The most common association is with optical scientist Christiaan Huygens and German Jesuit priest Athanasius Kircher. The exact origins are unclear, which may be due to early practitioners needing to protect

themselves from accusations of devilry (Herbert, 2000). The devil was considered a master illusionist and ultimate trickster. Magic lantern shows used both painted and then photographic images, which were projected onto a screen or wall. A projectionist could move the slides quickly, and if they contained images of progressive motion, they appeared “animated.” Various mechanisms were developed to move glass plates against one another to produce the illusion of movement. Dissolves and other time-based visual effects were also created by using multiple systems. As magic lantern shows were projected, a live showman, sound effect artists, and musicians provided the soundtrack. By the end of the 19th century magic lantern shows were common and the most popular form of moving image entertainment until the advent of cinema (Starkey, 2011). Magic lantern shows predate film and animation so can be thought of as the birth of animation (painted) and film (photographic). The integration of a live soundtrack also suggests the birth of sound design for moving image.

The most ambitious period in the programming of magic lantern shows began in 1854, when Henry Pepper became the director of the Royal Polytechnic Institution, a London society devoted to the exploration of science and the arts. They employed up to seven magic lanterns simultaneously, with a number of devices installed behind the screen to produce sound effects (Esteban & Segundo, 2010). By the end of the nineteenth century, magic lantern shows were the most popular form of moving image entertainment until the advent of cinema. Most shows were for general audiences, although images of phantoms, devils, and other macabre objects led to phantasmagoria, a precursor to the modern horror film. Etienne-Gaspard Robert, known by his stage name, “Robertson,” was a Belgian physicist, stage magician, and developer of phantasmagoria. Robertson’s work is documented in an autobiography written in the early 1830s and refers to the use of specific instruments to create sound effects (Mannoni & Brewster, 1996). According to Robertson, terror was best achieved when optical effects coincided with sound effects. In his memoirs, he discussed a technique for enlarging and reducing an image of Medusa, combined with the internal movement of her eyes, and the sound of the Chinese tam-tam. Other

references include the use of sound effects to emulate wind and thunder, and a glass harmonica to create unsettling and eerie “music.” Phantasmagoria marked a shift from the use of “real” sound effects to the use of unreal and surreal sound design effects for moving images.

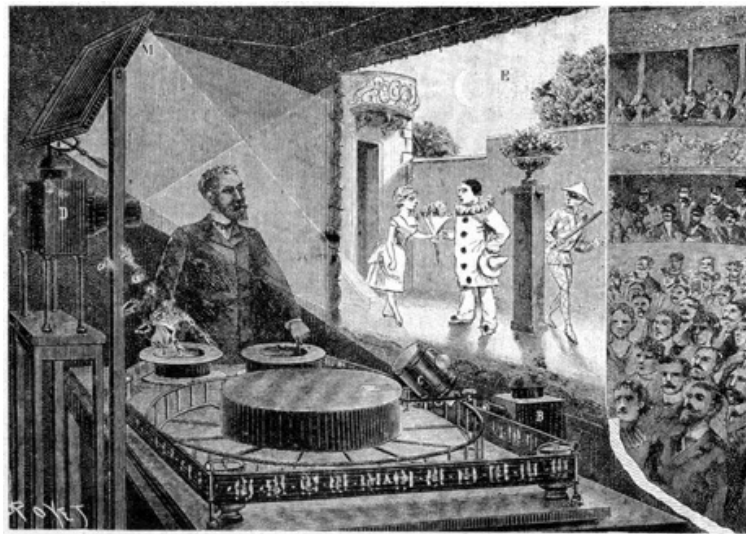


*Fig 1:5 Making sound effects at the Polytechnic in the mid-nineteenth century. From The Boys Playbook of Science (p. 306) London; George Routledge and Sons, Pepper, John Henry 1866*

### **Early Animated Films**

The first documented “animated films” were screened in Paris by Frenchman Charles Émile Reynaud, a painter of magic lantern slides who had refined the Zoetrope, creating the Praxinoscope. In 1892, he gave the first public performance of Théâtre Optique (Optical Theater) at the Musée Grévin in Paris. The show included three animated films, *Pauvre Pierrot* (Poor Pete), *Un Bon Bock* (A Good Beer), and *Le Clown et ses Chiens* (The Clown and His Dogs). The films were back-projected onto a screen while Reynaud manipulated the images. He created composite imagery by using static background images from one magic lantern projected with animated

characters and objects from another. Reynaud designed some of the drawings to be played backward and forward, creating sequential moves. These early screenings were also accompanied by a live soundtrack including sound effects (Bottomore, 1999). As a painter of magic lantern slides, Reynaud would have been privy to the sound techniques already employed or being explored by magic lantern and theater producers. There is little documentation about the use of sound in these screenings, but songs were sung in time with characters' gestures and sound effects were triggered. It is unclear if Reynaud was using a phonograph, sound effect artists, or sound effect devices, but it is possible he had developed a basic system for either triggering sound effects or cueing sound artists to perform live sound effects.



*Fig 1:6 Reynaud's Théâtre Optique, Musée Grévin in Paris 1892. From Le praxinoscope à projection d'Émile Reynaud pour La Nature, revue des sciences - 1882, n° 492, page 357.*

### **Audiovisual Events and Installations**

Scientists, psychologists, and epistemologists often assisted in the design of early audiovisual events. Investigations into the fields of optics and acoustics were quite extensive in the eighteenth and nineteenth centuries (Tresch, 2011). German physicist and musician Ernst Chladni (1756–1827) experimented with sound-image visualizations by drawing a bow across the edge of metal plates covered with sand to

show how different pitches produced different geometrical figures. Visual artists were also experimenting with the creation of audiovisual experiences during the late 1700s. English artist Robert Barker's 1781 patent for a 360-degree painting set up the groundwork for the panorama, which developed into a form of large-scale audiovisual entertainment. Artists employed techniques such as placing foreground props at the edge of the painting to create the illusion of looking into a 3D (three-dimensional) space. With the aid of lighting and the integration of viewing platforms, spectators were placed "in" the picture. Panoramas were also accompanied by sound effects, which involved teams of concealed sound effect artists manipulating a variety of sound props to create soundtracks. *The Mareorama* created by Hugo d'Alesi combined a large replica of a passenger ship deck, which rested on a universal joint and simulated the effect of a ship pitching and rolling, with moving panoramic paintings of landscapes. Props were used to hide the cylinders that supported two large canvases unrolled from port to starboard. The illusion was enhanced with the use of lighting, sound effects, costumed actors, and olfactory elements such as seaweed and tar to create an immersive experience. By the 1820's English visual artists were striving to create immersive works, which would engulf the viewer (Christie, 2011). Paintings got bigger as a new generation of young painters responded to "an explosion of new media in the surrounding world of late Georgian and Regency showmanship" (p.2).

The diorama, which originated in Paris in 1822, was another form of popular entertainment. Scenes were hand-painted on linen and selected areas were made transparent. A series of these multi-layered panels were arranged in a deep, truncated tunnel and illuminated by sun-light redirected via skylights, screens, shutters, and colored blinds. Dioramas were also accompanied by music and sound effects, which helped to create immersive experiences. British artists Clarkson Stanfield and David Roberts produced elaborate dioramas with sound effects, music, and live performers throughout the 1830s. Typical diorama illusions included sound and image effects

such as moonlit nights, winter snow turning into a summer meadow, rainbows after a storm, fountains, waterfalls, thunder, lightning, and ringing bells.

### **A New Art**

Prior to the panorama and diorama, multimedia styled presentations also integrated sound with visual effects. Eidophusikon (taken from Greek words meaning “image of nature”) was a mechanical, theater-inspired, moving image exhibition invented by artist Philip James de Loutherbourg during the late eighteenth century. Loutherbourg’s most commented upon works were the exhibitions held in a small theater he built in his home. He used lights, mirrors, colored glass, paintings, and sound effects to depict various scenes. To create the sound of thunder and lightning, Loutherbourg employed a sheet of thin copper suspended by a chain, which later became known as the “thunder sheet.” When the thunder sheet was shaken by one of the lower corners, it produced the rumbling of thunder and could also “mimic” the crash of lightning. Loutherbourg also integrated sound props for the creation of waves, wind, rain, and hail sound effects. An octagonal box with internal shelves containing small shells, peas, and light balls was wheeled upon its axis to create the sound of waves. Rain sound effects were created through a long four-sided tube with small seeds, which, depending on the degree of motion, forced the seeds to create a “pattering” stream to the bottom. Two circular machines were covered with tightly strained silk, which when pressed against each other through a swift motion, created a hollow “whistling” sound and gusts of wind. Accounts of these exhibitions from an artist called William Henry Pyne (1823) describe the events as genius, and “as prolific in imitations of nature to astonish the ear, as to charm the sight” (p. 296). He credited Loutherbourg with introducing a new art, which he called the “picturesque of sound.” Pyne’s descriptions of each of the sound props match descriptions and images of theater sound devices published in the early 1900s. The same devices were later used in the creation of radio drama, film, and animation soundtracks.





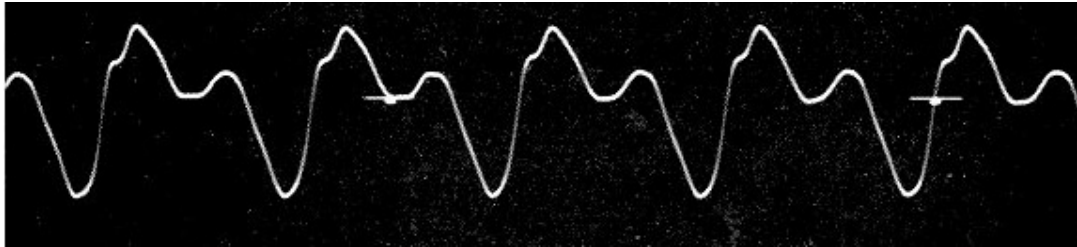
Fig 1:7: *The Eidophusikon* (ca. 1782), painted by Edward Francis Burney. From the British Museum

## THE FALLACY OF SILENCE

### Phonography and Mechanical Mimicry

The idea of combining recorded sound with moving images is older than film itself. It has even been argued that cinema was initially conceived as an aural medium “to which spectacles of various sorts might be appended” (Lastra, 2000, p.93). The first movie ever made was Eadweard Muybridge’s *The Horse in Motion* (Muybridge, 1878), whereas the first sound recording device was invented twenty years earlier. Édouard-Léon Scott de Martinville, a French printer, built a sound recorder in the late 1850s. His “phonograph” used a mouthpiece horn and membrane fixed to a stylus, which recorded sound waves on a rotating cylinder wrapped with smoke-blackened paper. He discovered sound waves could be traced as a visual image through the

vibrations of a bristle. There was no means to reproduce the sound, but it was an important forerunner to Thomas Edison's phonograph.



*Fig 1:8 Facsimile of an early Phonautograph tracing. From Jules Jamin, Edmond Bouty, Cours de physique de l'École Polytechnique, ed. 2, vol. 2, p. 629 (fig. 515)*

A number of inventors around the world were working on various systems, but credit for inventing the phonograph is usually attributed to Thomas Edison. In 1877, Edison designed the “tin foil phonograph,” which consisted of a cylindrical drum wrapped in tinfoil and mounted on a threaded axle. A mouthpiece attached to a diaphragm was connected to a stylus that etched vibrational patterns from a sound source on the rotating foil. For playback, the mouthpiece was replaced with a “reproducer” that used a more sensitive diaphragm. The first recordings were faint and “tinny” sounding, but they marked the start of what became known as sound recording and reproduction.

After inventing the phonograph, Edison started exploring the idea of coupling phonograph records with “instantaneous photography.” In 1887, he wrote a paper expressing the possibility of creating a device that would do for the eye what the phonograph had already done for the ear (Kellogg, 1955). Edison is documented as anticipating combining records with instantaneous photography as early as 1878 (Feaster & Smith, 2009). However, while the sound recording industry was advancing, the film industry was still in its infancy. Synchronized film sound was only made practical in the late 1920s with the introduction of sound-on-disc and sound-on-film systems. Despite this, the silent film era (1894–1928) was not actually

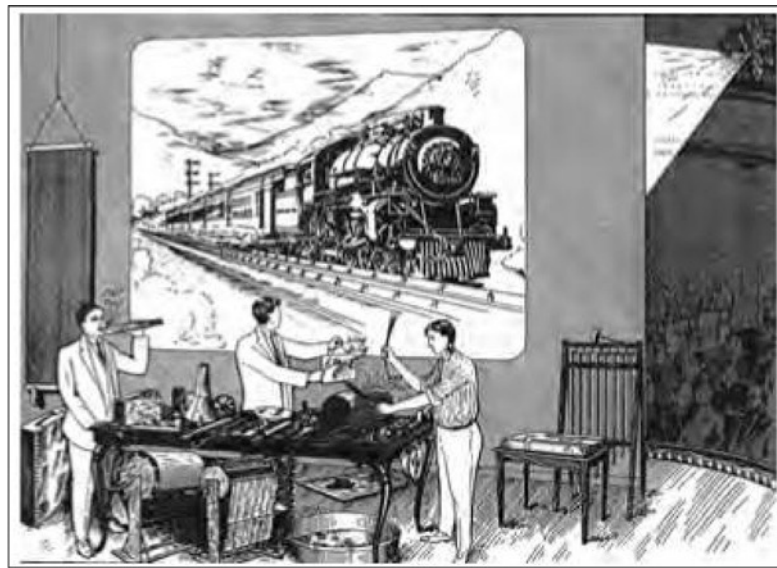
silent. The soundtrack was created live and in much the same way as it had been performed for magic lantern and theater shows.

### **Live Film Soundtracks**

As has been noted by Rick Altman (2007), silent film sound is a difficult subject to research, and largely due to the ephemeral nature of early film sound, both music and effects. However, it was quickly recognized that music contributed atmosphere to the film experience and provided additional advantages such as masking the sound of the projector, preventing audiences from talking during screenings, and creating a sense of continuity between shots (Miller, 1982). Small town and neighborhood movie theaters usually had a pianist, while large city theaters employed organists or ensembles of musicians. Less documented is the use of sound effects, which also became a common practice. Massive theater organs were designed to create sound effects, plus fill the gap between the simple piano soloist and a larger orchestra. The organ provided a cost-effective alternative and could simulate orchestral sounds, percussion, and sound effects such as train and boat whistles, car horns, bird whistles, pistol shots, ringing phones, the sound of surf, horses' hooves, smashing pottery, thunder, and rain.

American entertainer and filmmaker Lyman Howe was believed to be the first person to use a phonograph and live sound effects in the presentation of movies. Howe started his career by touring with a phonograph presenting recorded "concerts" of music, speech, and sound effects. Howe presented his first movie in Pennsylvania, USA, in December 1896, making him the first person to use sound and film in tandem for commercial purposes. After acquiring Edison's *Black Diamond Express* (White, 1896), he recorded an approaching train. According to accounts the rushing of steam, ringing of the bells, and the roar of the wheels made the scene feel so realistic audiences were startled into physically getting out of the way (Musser & Nelson, 1991). Audiences flocked to Howe's shows, and by 1899 he had added a backstage

crew to provide sound effects. On some films the sound team comprised up to thirty people who, after having rehearsed with the pictures, performed the soundtrack concealed behind the screen. These early films were not perceived as films in the modern sense of the term, but as “animated photographs,” “living” or “magic pictures.” Voice actors and sound effects performers were employed in an effort to make the pictures feel more “real.”



*Fig 1:9 Performing behind the screen, 1908. Courtesy of George Eastman House*

By 1908 a number of entertainers were presenting “talking” films, using actors behind the screen, some twenty years before “the talkies.” The use of voice actors was not a new practice; a narrator or lecturer was often hired by a film exhibitor to introduce and interpret a film for the audience. This also involved reading the inter-titles, which were the short, written lines of text descriptions and dialogue inserted into films. In Japan a person, or a group of people, always supplied a live verbal component to films. Benshi, as they were called, were influential and considered an integral part of early cinema. They appeared before a screening to give introductory remarks about the

content of the film about to be presented, sometimes voiced the on-screen characters, and provided translation for foreign films.

### **Sound Effect Machines**

Standalone sound effect machines were later developed specifically for the creation of cinema sound effects. These units had various handles, which when turned created sound effects. The first machine was patented in France (1907), followed by the “Allefex” in 1909, which was invented by A. H. Moorhouse and described as “the most comprehensive and ingenious machine ever made for the mimicry of sound” (Talbot, 1914, p. 140). Striking a drum at the top of the machine where a chain mat had been placed created a gunshot. A machine gun was created by turning a shaft with tappets that struck and lifted up wooden laths, which subsequently released them to strike against the framework of the machine. The interior of the drum was fitted with three drumsticks, which could be manipulated by turning a handle to vary the number and speed of shots according to the picture being screened. At the bottom of the machine was a large bellow controlled by the foot, which in conjunction with two handles produced the sound of exhaust steam from a locomotive and the rumbling of a train rushing through a tunnel. Running water, rain, hail, and the sound of rolling waves were created by turning a handle to rotate a ribbed wooden cylinder against a board set at an angle, from the top of which was a hanging chain. The crash of pots and pans was produced by the revolution of a shaft with mounted tappets striking against hammers, which in turn came into contact with a number of steel plates. Pendant tubes produced church bells, a fire alarm, and a ship bell. A revolving shaft carrying three tappets that lifted up inverted cups created the sound of trotting horses. The shaft was movable so that a trot could be converted into gallop, and a muffling attachment created the illusion of distance. Thunder was made by shaking a thunder sheet of steel hanging on one side of the machine. Revolving a cylinder against a steel brush made the puffing of an engine. The press of a bulb produced the bark of a dog, bellows and another attachment produced a warbling bird, and the cry of the baby was created through the manipulation of a plughole and bellows.

### Trap Drummers

During early 1900s, the “trap drummer” (or pit-drummer) migrated from theater and vaudeville into performing sound effects for silent films. The first drum sets emerged in the second half of the 1800s when it was realized there were advantages to having a single person play a bass drum, snare drum, and cymbal at the same time. Later drummers began adding other “noise-making” devices like woodblocks, temple blocks, gongs, chimes, glockenspiel, timpani, and various sound effects. A newspaper article entitled “*The Trap Drummer*” (The Tropical Sun, December 19, 1914) indicates there was probably a range of skill levels and variations in sound effect props. In the article, the author marvels at the drummer’s ability to drum and perform sound effects to moving images at the same time. The “traps” mentioned include sleigh bells, sandpaper, an eggbeater, and a nutmeg grater. Given the need for synchronization of sound effects with pictures, highly skilled drummers were perceived as having the sense of rhythm, timing, and hand-eye coordination needed to play sound effects for moving images.

Reviews of films with live sound effect performers were initially mixed, and it is impossible to tell if an organ, live sound effects artists, a machine, a drummer, or a phonograph record produced the sound effects for “silent” films. *Moving Picture World* film reviewers noted the ill-considered and overuse of sound effects, while others responded favorably:

Where a sound will have a direct bearing and effect upon something that is happening in a picture, such as the ringing of a door bell, the shot of a gun, wind in a storm, etc., then by all means come in with it strong, but on the other hand, when you see a calf in the background of a pretty farm scene don’t detract from the acting by jangling a cow bell when it has no bearing on the picture. (Hoffman, 1910, p. 185)

The sound effects during the presentation of “Trawler Fishing in a Hurricane” fairly captured the audience. The shriek and moan of the wind, the swish of the flying scud, the resounding chug of heavy seas, as they were shipped, were all reproduced with a realism that carried the spectator into the throes of the storm. (McQuade, 1912, p. 1107)

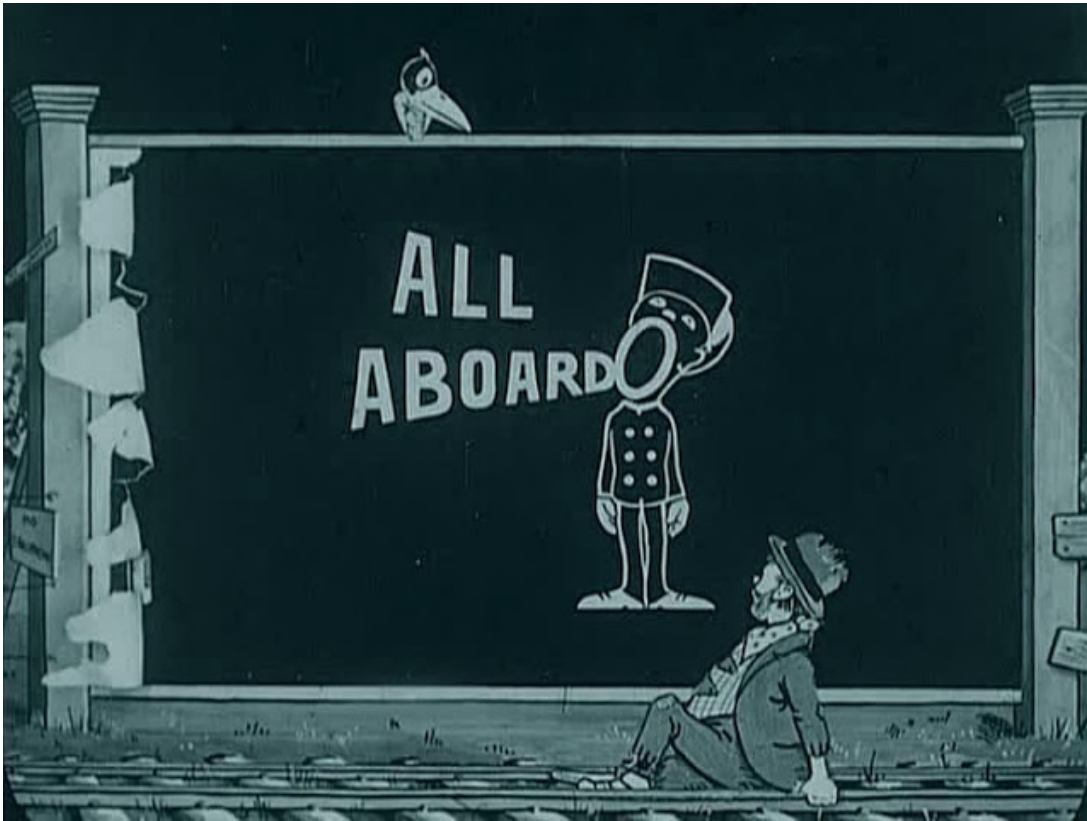
From around 1910, the idea of accompanying pictures with sound effects was fashionable. In 1912, British writer Frederick A. Talbot wrote, “When a horse gallops, the sound of its feet striking the road are heard; the departure of a train is accompanied by a whistle and a puff as the engine gets under weigh; the breaking of waves upon a pebbly beach is reproduced by a roaring sound” (p. 139). Talbot also wrote about some of the problems that had started to emerge, such as the “unpleasant shock” of hearing the wrong sound effect, “when the realism of a medieval battle is heightened by the vigorous rattling of a machine gun, or when horses galloping over the turf make a clatter that only a city pavement could cause” (p. 139). Problems aside, Talbot argued that since sound effects were indispensable to the “legitimate” stage (meaning theater), it was only logical that the use of sound effects should extend to moving images. He identified and advocated for what he saw as an emerging trend, employing sound effects with as much care as the pictures. It was proposed that high-quality and well-rehearsed sound effects were good for business.



Fig 1:10 An American effects setup. From *New York Herald*, April 17, 1910

Many early films have been lost due to the fragility of early film (celluloid) and phonograph records. Often when a film is restored, a new soundtrack is added, or the film is presented mute. *The Dickson Experimental Sound Film* is one of the few early films to be restored with the original sound. The film was produced by William Dickson in late 1894 or early 1895 and is considered the first known film with recorded sound. It also appears to be the first motion picture made for the Kinetophone, the proto-sound- film system developed by Dickson and Edison. In 2010, over 100 silent films were discovered in an archive in New Zealand, including a film by Lyman Howe called *Lyman Howe's Ride on a Runaway Train* (Howe, 1921). The film has been recently restored and is described as a thrill-packed short accompanied by sound discs. It's an experimental live-action animated film with sound, and, given the limited technology at the time, it's not surprising it caused quite a sensation.





*Fig 1:11 Lyman Howe's famous Ride on a Runaway Train (1921). From Educational Films Corporation of America*

## **RADIO WITH PICTURES**

### **Mental Imagery**

Often overlooked is the impact early radio production had on the development of sound design practice and techniques. During the 1920s, radio and recorded music were growing in popularity, and new developments paved the way for film sound. In much the same way, radio sound effect artists also paved the way for film sound design. Radio was initially a military communication tool, which evolved into a popular entertainment, culture, and news medium. Research in “wireless telephony” during World War I led to viable microphones and amplifiers that made radio broadcasting possible. Early radio drama was essentially broadcasted theater, and the first shows were broadcast directly from theaters. It took a while for producers to

realize radio, as a purely aural medium, needed a different approach to scripting and production. Frequently described as “theater of the mind,” the success of a show hinged on involving the listeners’ imagination (Verma, 2012). Unlike theater and film, radio drama didn’t need costumes or sets; sound, or more precisely sound effects, created the imagery.

Ora Nichols and her husband, Arthur, are believed to be among the first to bring sound effects to radio. Ora, who led the first in-house sound effect team, is considered one of the most pioneering figures in early sound effects creation (Sewall, 2014). Ora and Arthur were both musicians who migrated from vaudeville to silent film and then to radio. Arthur was a violinist but had switched to playing drums so he could play sound effects for silent films. When the silent era ended and the sound film was introduced, they both started working in radio. While this might sound like a strange choice in mediums, their decision to work in radio production was most likely due to the nature of early sound films (“the talkies”), which were dialogue-driven so presented limited opportunities for creative sound artists.



*Fig 1:12 Sound effects chief Ora Nichols assisted by George McDonnell, at work on the CBS radio program The March of Time (1935). From Tower Radio, January 1935, p.24*

### **Sound Effect Artistry**

By the late 1930s, radio drama was hugely popular. Sound effects were initially created manually or vocally, until superseded by sound effects on records followed by tape. As Robert L. Mott (1993) details common manual effects included running a fingernail along the edge of pocket comb for the sound of crickets, snapping open an umbrella for the sudden ignition of fire, cellophane or a bundle of bamboo splints twisted together to produce the sound of fire crackling, squeezing seltzer bottles into a pail for milking a cow, shaking cups containing BBs for a rattlesnake, twisting wallets for getting in or out of a saddle, plunging a knife into a cabbage or melon for body stabs, shaking a small chain attached to piece of leather for a horse harness, and scratching rough paper with a paper clip for writing with a pen. Radio sound effect departments grew to house numerous sound props. Some were custom designed and often for the production of multiple sound effects. A slatted metal device was used to create the sound of a guillotine and the sound of footsteps on a fire escape. Props like kitchen sinks were built to cover everything from dishwashing to drink pouring, kettle filling and rainstorms. Foley sound effects such as footsteps, impacts, and falls were especially important in radio drama as they gave stories movement, a sense of perspective, and realism. Plywood and marble slabs were used for different hard surfaces, and boxes were filled with different materials such as gravel. Palm fronds and other plant materials were used for footsteps in the forest, bush, or jungle.

On comedy shows, sound effect artists were considered comedians in their own right. Typical comedy effects included hollow wood hits and boings, which were also common in early animation. To “personify” a car in a comedic sense involved combining sounds for the car with additional and typically vocal effects, of the car coughing, wheezing, gasping, and spluttering. Old motors attached to riveted metal buckets for nuts, bolts, and nails to be dropped in created rattles, clanks, and bangs. “Authentic” sounds lack comedic character, whereas combining sound and vocal effects created a “personality” and added comic value. Comedy shows also used studio

audiences to provide live laughter, and sometimes “clagues,” who were people hired to laugh in different styles. Another common strategy for devising effects was based on phonetic imitation, or onomatopoeia, which are words that phonetically resemble or suggest the source of the sound that they describe. This includes animal sounds such as “oink” or “meow” and also applies to the naming conventions of sound props designed to create specific effects. One of the most obvious examples is the “boing” box, which was used for creating comic “boing” sound effects.

Early sound effect artists faced many of the issues still prevalent today. There was a perception that all sound people thought and worked in exactly the same way and that all sound effects took the same amount of preparation regardless of the actual sound. Playing the sound effect of a thunderclap from a sound effect record was not the same as physically creating the sound of body falling in mud, or performing two live sound effects at the same time, such as typing and a door knock, which required one hand typing and one hand knocking, or two people were needed. Even with the introduction of sound effects on records, certain sounds were difficult to create and involved the use of several turntables or performers. Creating a steam train crash consists of several different sound effects: the sounds leading to the crash, the crash, metal skids, iron wheels locking, brakes on rails, steam, and the collision. The less obvious or complex types of sound effects required deconstructing the intended sound and finding items to create the “right” combination of sounds; for example, the sound of blood boiling was created through blowing bubbles in syrup with a straw. Syrup has a similar consistency to blood, while blowing bubbles through a straw provides the boiling action. Late script changes also posed problems because sound effects always needed to be rehearsed before the live performance. Another common misconception sound effect artists faced stemmed from the lack of understanding concerning weight, scale, and volume. Mott (1993) tells the story of Jim Rogan, a sound effect artist working for CBS who needed to create the sound of a turbulent river and a stampede of horses. Rogan stood in a tub of water and thrashed his feet while drumming coconut shells in

dirt. The director of the show was underwhelmed with the results, which would have sounded too “small” and not what the director had envisioned.

An additional complication was the “visual director,” who based the appropriateness of a sound effect on how the props looked, as opposed to how they actually sounded. Orson Welles was known as a visual director. In a scene that required the sound of a lawn being mowed, he requested the studio be filled with “real” grass and a “real” lawn mower to be pushed by a “real” actor. The usual technique for creating the sound of lawn mowing was using an eggbeater or a stripped-back lawn mower and shredded newspaper. Welles wanted realism but overlooked how sometimes the “real” sound does not actually sound real. The show also required a number of rehearsals, which left no grass to cut, which made the resulting sound even more unconvincing. In another show that required footsteps on sand, Welles organized for the studio to be filled with sand. The usual technique for creating footsteps in sand is using a pit or box filled with dirt or cornstarch. Footsteps in sand are a difficult sound effect to create because the “real” sound is very subtle and low in level (volume/amplitude). If the level is raised, so are the actors’ voices and any other sounds such as script rustles. Sand is very fine, while dirt is grittier and gravel even grittier. Certain sounds (“grit”) contain more mid-high frequency content, which are perceived as being louder. In both situations, the original technique was reemployed.



*Fig 1:13 Sound effect artists in Back of the Mike (1938). From Jam Handy Organization (JHO)*

Radio shows took anywhere between a day and a week to prepare for, and busy shows needed at least two sound effect artists. Everyone involved in a show attended a read-through while the director worked out rough timings. Corrections were made and then the show was rehearsed with sound effects. Rehearsals were necessary because if mistakes were made, the whole show had to be re-performed. The studio engineer was responsible for making sure the various sound components were mixed appropriately.

As the popularity of radio drama increased, producers and directors sought greater realism, or at least the idea of realism. Some producers considered sound effects as artificial and deceptive, although this was more of an issue on news and current affairs shows. Various sound effects were used in news shows, although they were generally restricted to simple signature sounds. Current affair shows such as *The March of Time* (1931–35) made no attempt to hide the use of sound effects because the show was considered news “dramatizing.” A similar debate arises in documentary filmmaking; some documentary filmmakers avoid using sound design and music because of the emotive and subjective impact, while others take a more cinematic approach to the use of sound. One of the most famous radio dramas was Orson Welles’s adaptation of H. G. Wells’s novel *The War of the Worlds*, broadcast in the 1930s. Welles’s version of the story was sound designed and suggested aliens from Mars were invading New Jersey, leaving a trail of death and destruction in their wake. According to some sources, people thought it was real and believed that the end of the world had arrived, which later caused widespread outrage in the media. An article printed in the *New York Times*, “*Radio listeners in Panic, Taking War Drama as Fact*”, details the wave of hysteria the programme triggered. Despite complaints or possibly because of them, Welles’s career took off. The use of sound in his films, most notably *Citizen Kane* (Welles, 1941), was informed by his prior experiences in radio drama production.

As radio fidelity and recording technologies improved, manual sound effects were considered inadequate and the use of sound effect records started to replace the performing of effects. A record library of hundreds of sound effects took up less space than sound props. Sound effects records were more economical; a single person with three turntables could create an effect that would require three manual sound artists. Record companies started releasing more sound effect records and improved on the quality. As recording technology evolved, audiotape and cartridge machines replaced records, followed by CD libraries. Today radio drama’s popularity waxes and wanes. Advances in digital recording and the Internet have revived it to an extent,

and some countries still produce radio drama, radio art (or sound art), and radio documentaries. Audio books employ the same techniques and sometimes to a scale that rivals the film soundtrack. Despite changes in technology, the practice is still employed in moving image disciplines by sound designers and Foley artists. While there are numerous sound effects libraries, many sound and Foley effects are unique to a project, so are still recorded “live” while performing to pictures.



*Fig 1:14 Performing sound effects for The March of Time (1935). Promotional photograph released without copyright notice from Culver Pictures, Inc.*

## TRANSITIONING TO SOUND

### Amped and In Sync

The silent film era ended in 1927 with the arrival of the “sound film,” a motion picture with synchronized sound or sound coupled with image, as opposed to a film accompanied with a live soundtrack. While the union of sound and image was a long-standing ambition, the two mediums were not so easily combined. Image was recorded



in a linear and discontinuous fashion and sound in a circular and continuous fashion, which posed a problem (Monaco, 2009). In addition, early recording mechanisms were not sensitive enough to capture quality dialogue, and the lack of amplification made it impossible to reproduce sound for large audiences. Films with sound were screened during the early 1900s through the use of a phonograph running in mechanical synchronism with pictures; however, reliable synchronization was difficult to achieve due to mechanical failures. A number of inventors throughout the world had been trying to create the technology to combine sound and image, and effectively the “silent” film era was a period of development. While inventors were intent on the unification of sound and image, the film industry was initially resistant to the idea. Poor sound quality, synchronization problems, and inadequate amplification were all significant hurdles (MacGowan, 1955).

### **Sound-on-Disc**

The very first sound films were limited to short loops viewed and heard by a single person through the combination of a Kinetoscope and Kinetophone. The Kinetoscope created the illusion of movement through a strip of perforated film bearing sequential images over a light source with a high-speed shutter. Edison introduced the Kinetophone in 1895, which incorporated a cylinder phonograph, effectively creating one of the first audiovisual entertainment devices. Sound was heard through tubes similar to a stethoscope, connected to a diaphragm and stylus assembly.



*Fig 1:15 Kinetophone/Kinetoscope. From <http://www.victorian-cinema.net/>*

In addition to the work undertaken by Edison, a number of other inventors were experimenting with sound and image synchronization. In 1902, Léon Gaumont developed the Chronophone to synchronize pictures with a phonograph using a switchboard. A projector and two phonographs could be linked, and synchronization controlled by a dial (Gomery, 2015). Chronophone films were created using a similar technique to modern music videos, with the artist miming to a pre-existing audio recording. French civil engineer, musician, and painter Auguste Baron was also one of the first to experiment with sound films. In 1896, Baron and Frédéric Bureau patented a system of shooting and projecting sound films recorded on disc. An electrical device on the motor-driven camera regulated the wax cylinder recorder to maintain synchronization. Between 1896 and the early 1900s, a number of other inventors were working on linking phonograph records and films with various degrees of success and failure.



*Fig 1:16 The Chronophone. From Keystone-France, Getty Images*

By 1925, Western Electric's Bell Telephone Laboratories believed they had perfected the Vitaphone, which was based on the synchronization of film with a phonograph record. A recording lathe cut an audio signal–modulated spiral groove into the polished surface of a slab of wax-like material rotating on a turntable. The wax was too soft to be played in the usual way, but a specially supported and guided pickup was used to play it back immediately to detect any sound problems that might have gone unnoticed. If there were problems, scenes could be re-shot while everything was still in place. In a promotional video Edward Craft, the executive vice president at Bell, described the Vitaphone as “a development which is destined to create an entirely new art where the medium of expression is the synchronized reproduction of sound and scene” (Craft, 1926). A turntable was geared to a projector and driven by a constant-speed electric motor. The needle generated an electrical current with the same characteristics as the sound that produced the original record and was amplified providing enough energy to power loudspeakers behind the screen. The first Warner Bros. Vitaphone features were *Don Juan* (Crosland, 1926) and *The Better 'Ole*

(Reisner, 1926), however, they had only synchronized music and sound effects. *The Jazz Singer* (Crosland, 1927) is considered the first feature-length motion picture with synchronized dialogue sequences and is hailed as the birth of the “talkies.” The film contains synchronized singing sequences and about two minutes of synchronized dialogue. The rest of the dialogue was presented through inter-titles, the common standard in silent movies. Early feature films with recorded sound typically included music and sound effects only. Major Hollywood studios made a “silent” version (with music and effects) and a “sound” version (with dialogue), which may be why many still consider non-dialogue-driven films as “silent” today.

The Vitaphone was still susceptible to synchronization problems. If records weren’t cued correctly, the sound would start out of synchronization with the image. Projectors had special levers to advance and delay synchronization, but only to a certain extent. The other limitation was the inability to physically edit material. The process entailed a microphone recording the sound performed on set directly to a phonograph master, which made it impossible to edit recordings. There was some experimentation with mixing, and dubbing systems were developed so that source discs could be cued and dubbed to a new master disc, but the wax master could not be paused, so each playback turntable had to start at just the right moment. The Vitaphone system was the leading brand of sound-on-disc technology at that time, but as sound-on-film systems were improved, they became the dominant industry standard for talking pictures.



*Fig 1:17 First-nighters outside the Warners' Theater before the premiere of Don Juan (1926). From US. National Archives and Records Administration*

### **Sound-on-Film**

The problems associated with sound-on-disc systems led to the exploration of other concepts, most importantly the printing of picture and sound on the same piece of film. Sound was converted into electrical signals, translated into light signals and printed. Eugene Lauste, a French inventor, developed an optical system called “Phonocinematophone” in 1910, but the system lacked the amplification needed for playback in theaters. Another system, developed by Polish-American inventor Joseph Tykocinski-Tykociner, was successfully demonstrated to a large audience in 1922 (Lewis, 1981). Tykociner is believed to be the first, or one of the first, to consider the idea of photographing sound. He was an assistant research professor at the University of Illinois and given permission to experiment with sound pictures. Jacob Kunz, a

colleague and theoretical physicist, had developed a photoelectric cell, which Tykociner used to convert sound impulses to light.

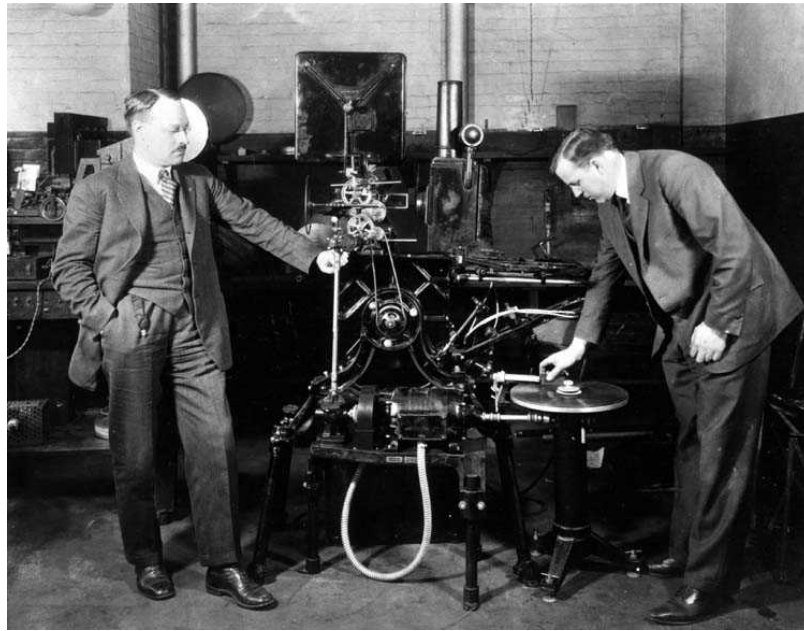
Three competing technologies surfaced during the 1920s: RCA's Photophone, an optical sound, "variable-area" film exposure system, and two "variable-density" sound-on-film systems, Fox-Case's Movietone and Lee de Forest's Phonofilm. Variable density meant that the density of the soundtrack varied in accordance with the amplitude of the audio signal. Variable area meant that the width of the soundtrack varied in accordance with the amplitude of the audio signal. The soundtrack was photographically recorded on the film by a beam of light modulated by the sound waves. Sound was reproduced during projection by directing a beam of light through the soundtrack onto a photocell. The photographically recorded electrical waveforms were then translated back into sound waves and amplified as a film was projected.

Existing research suggests de Forest improved on the work of Finnish inventor Eric Tigerstedt, German inventors Josef Engl, Hans Vogt, and Joseph Massole, who were developing the Tri-Ergon process (Gomery, 1976). Tigerstedt was interested in sound recording technology and made significant improvements to the amplification capacity of the vacuum valve. He developed a prototype for recording sound on a metal wire as early as 1912 and was confident sound could be recorded directly on motion picture film. While his sound-on-film technology wasn't commercialized, he also developed directional loudspeakers and predicted future inventions such as the mobile phone. The first sound short to use the system, *Das Mädchen mit den Schwefelhölzern* (The Little Match Girl), directed by Guido Bagier premiered in 1925, which ended in catastrophe. The sound cut out and the audience responded negatively. Years later, a sound-on-film technique based on the Tri-Ergon system gained wider acceptance in Europe.

The quality of de Forest's Phonofilm was initially poor, but with help from American inventor Theodore Case, de Forest made some enhancements, which led to the first commercial screening of a short sound film in 1923. From 1922 to 1925, Case and de

Forest collaborated in the development of the Phonofilm system; however, Case ended the relationship due to de Forest's tendency to claim sole credit. Case had developed an interest in using modulated light to carry speech as a student at Yale University. In 1914, he established a laboratory to study the photoelectric properties of materials, which led to the development of the Thallofide tube, a light-sensitive vacuum tube. He also contributed to the development of the Aeo light, a light source that could be modulated by audio signals and used to expose sound in sound cameras. In 1922, Case and his assistant Earl I. Sponable developed the Movietone, a modification of the earlier Phonofilm system.

Charles Hoxie created the Pallophotophone, which became the RCA Photophone. Hoxie worked for General Electric (GE) following World War I and developed a photographic recorder to record transoceanic wireless telegraphy signals. The recorder was later adapted to record voice and used to record speeches for broadcast. The Pallophotophone could record and replay multiple audio tracks and is considered the world's first effective multitrack recording system, predating magnetic tape-based systems (Kellogg, 1955). In 1925, GE launched a program to commercialize sound-on-film equipment based on Hoxie's work. A number of demonstrations were given in 1926 and 1927 under the new name of Photophone, and the first public screening was a sound version (music plus sound effects only) of the "silent" film *Wings* (Wellman, 1927).



*Fig 1:18 Sound-on- disc, Warners Vitaphone. From ERPI, Warner Vitaphone*

### **End of an Era**

The invention of the Audion tube in 1906 by Lee de Forest was integral to the sound film. Western Electric acquired the rights to it in 1913 and developed it into a more reliable device. It was the first widely used electrical device that could provide enough amplification for a large theater. In 1929, Max Fleischer codirected a short, animated film called *Finding His Voice* (Goldman and Fleischer, 1929). Western Electric sponsored the film as a way of educating moviegoers about their sound-on-film process. The film is an “animated cartoon synchronized to voice and sound” that outlines how the Western Electric sound-on-film recording system worked. The film opens with a hand drawing a strip of film that comes to life as a talking filmstrip (“Talkie”), joined by an “out of work” silent filmstrip (“Mutie”) wanting to make the transition to sound. Talkie takes Mutie to see “Dr. Western,” who guides him through the film sound process. The film effectively marks the end of the silent era, which created an upheaval in the industry. Silent film studios became obsolete and movie theaters began installing sound systems. Films that began production as silent films were transformed into sound films.



However, not all filmmakers embraced the sound film. It was argued that the “talkie” was nothing more than a filmed play or recording of everyday life, which subverted the aesthetic virtues and potential of cinema as an independent art form. The criticism towards film’s relationship with theatre was largely due to the limitations of sound cinematography, and the fact that Hollywood had been using stage plays as source material (Crafton, 1999). Cameras were noisy, so needed to be housed in large sound-insulated booths. Acting suffered due to the use stationary or hidden microphones, which constricted the movement of actors. Directors became frustrated by the reliance on dialogue and the immobilized camera. In 1928, Russian filmmakers Eisenstein, Pudovkin, and Alexandrov issued a joint statement to voice their concerns (Weis & Belton, 1985). They saw sound recording and the sound film as something of a double-edged sword. Pudovkin encouraged experimentation with the sound-image relationship and believed creative sound-image manipulation would reveal meaning, add depth and heighten perceptions (Pudovkin in Weis & Belton, 1985). Eisenstein was receptive to the potentials of the sound film and recognized the opportunities and complexities in acoustic and optical counterpoint (Eisenstein in MacCann, 1966). While it was a significant development, they feared sound would be commercially exploited by Hollywood in the form of “talking” films, which would destroy the visual montage they were responsible for developing. Another issue was international sales. A film produced in London would be in English and therefore only understood by people who also spoke English. Foreign language dubs were considered complex and expensive, and subtitles were not given much thought at that time. While the negativity toward the sound film appears “anti-sound,” Eisenstein, Pudovkin, and Alexandrov were concerned with what they perceived as sound being employed “incorrectly,” primarily the preoccupation with dialogue to the detriment of other elements. The problems caused by the transition to sound were soon solved with “blimps,” designed to suppress camera noise, dollies, and boom microphones that could be held out of frame and move with the actors. Initial misgivings eventually

gave way to creative exploration of sound and sound-image arrangements.



*Fig 1:19 Finding His Voice. From Finding His Voice (1929, dir. Max Fleischer and F. Lyle Goldman), Western Electric Sound System, Inkwell Studios*

### **A New Form of Composition**

Eisenstein, Pudovkin, and Alexandrov were principally concerned with the contrapuntal use of sound, which they believed would elevate the visual montage and perfect the cinematic art form. The term “contrapuntal” is commonly associated with music and counterpoint, the technique of combining melodies. In the broader context, counterpoint describes any element that is juxtaposed with another. Filmmakers started to recognize the opportunities for aural and visual counterpoint, and creative manipulation of sound and image was seen as a means for revealing meaning, adding depth, and heightening perceptions:

Sound, treated as a new montage element (as a factor divorced from the visual image), will inevitably introduce new means of enormous power to the expression and solution of the most complicated tasks that now oppress us with the impossibility of overcoming them by means of an imperfect film method, working only with visual images. (Eisenstein et al. in Weis & Belton, 1985, p. 85)

In the United Kingdom, Alfred Hitchcock directed the first all-talking film, *Blackmail* (Hitchcock, 1929). The film is based on a play about a woman who is blackmailed after killing a man. After starting production as a silent film, British International Pictures decided to convert *Blackmail* into a sound film. Hitchcock initially ridiculed talking films, but he later deemed the arrival of sound as bringing a new dimension to cinematic expression (Weis, 1982). While music had previously dominated the film soundtrack, Hitchcock pared back music to experiment with the expressionistic use of dialogue and sound effects. He was later known for preparing detailed lists of sounds for his films. For the knife sound in *Psycho*'s (Hitchcock, 1960) shower scene, he conducted blind sound tests using different types of melons. In the film, a casaba melon was used to simulate the sound of flesh being stabbed (Roman, 2009). Although uncredited until 1939, British sound editor Harry Miller worked on *Blackmail* and became one of the first known “dubbing editors.”



Fig 1:20 Hitchcock and Anny Ondra on the set of *Blackmail*. From Magno, Contributor, Getty Images

*M* (1931) was Austrian-German filmmaker Fritz Lang's first sound film. The film, credited with establishing the serial killer and police procedural genres, depicts a manhunt for a serial killer of children. The soundtrack includes a narrator, dialogue, Foley, sound effects, and silence to inform the narrative. Like Hitchcock's work, *M* experiments with the expressionistic use of sound. Dialogue is fairly minimal, especially for a "talkie," and there's an absence of music. The film was one of the first to use a leitmotif, associated with the central character, Franz Becker, who whistles "*In the Hall of the Mountain King*" from Edvard Grieg's *Peer Gynt* Suite No. 1. Later in the film, whistling lets the audience know that he is nearby. His presence is heard rather than seen; the whistling is a stand-in for the murders.



Fig 1:21 *M* (1931, dir. Fritz Lang). From Nero-Film AG

From 1928 to 1931, the major emphasis in film sound was on production (location) sound, and film studios, labs, and equipment suppliers were largely focused on sound capture. Soundtracks were mono and had a limited bandwidth (40Hz to 10kHz) and dynamic range (around 40dB). Systems were also noisy. It was not until 1966 that Dolby created the first product to reduce noise in music recordings. *A Clockwork Orange* (Kubrick, 1971) was the first film to use Dolby noise reduction. As the quality of recording and reproduction technology increased, it became apparent that other enhancements could be made, after production. Innovations in technology presented an opportunity to revisit the soundtrack in postproduction. The sound film initiated “multitracking,” which meant that separately recorded audio sources could be replayed and mixed together. Re-recording, which had previously only involved the parts of a film requiring music and effects, started to become a production standard for the entire soundtrack (Jacobs, 2012). In 1931, engineer Kenneth Morgan anticipated the importance of this change and predicted postproduction sound would become an art in itself, “a new form of composition in sound where the artist’s keyboard commands the sounds of the universe” (Morgan, 1931, p. 154). While the term “sound design” was introduced decades later by Walter Murch, the concepts that underpin contemporary sound design and re-recording were being established shortly after the transition to sound.

Today film critics and reviewers often consider non-dialogue or non-musically-driven films as silent or visual, when in reality they are reliant on sound effects, the treatment of sound, and the overall soundtrack mix. Sylvain Chomet’s (2003) first feature-length animated film, *The Triplets of Belleville* (Les Triplettes de Belleville), is a good example of a film that reviewers described as silent. The film centers around Madame Souza and her orphaned grandson, Champion. Madame Souza encourages and trains Champion for the Tour de France. While competing in the race he is kidnapped by the French mafia. Madame Souza and Champion’s dog, Bruno, set out to find him. They make their way to the city of Belleville and encounter a former jazz-singing trio called

the Triplets of Belleville. The women band together to rescue Champion. The story is narrated through the use of atmosphere, sound effects, and broadcast segments. Sound becomes character, punctuates individual narratives, and adds a sense of realism to environments. The lack of dialogue allows sound design and music to actively partake in the storytelling, which in turn focuses the audience on the visual storytelling. As a consequence, there is an illusion of silence and a perception that the film is visual, despite the storytelling being very audio-visual. The other interesting aspect of the film is that the Triplets are sound effect artists, and props become “instruments” when they perform live with a newspaper, a fridge, and a vacuum cleaner. Sound is in the narrative and becomes an active part of the film’s overall aesthetic.



*Fig 1:22 The Triplets of Belleville (2003, dir. Sylvain Chomet). From Les Armateurs, Production Champion, Vivi Film*

## ANIMATION FINDS ITS VOICE

### **The Thing That Hooked The Crowds**

During the silent film era, animated films (or “cartoons”) had minimal status, and many of the studios specializing in “silent cartoons” went bankrupt before the coming of sound. The studios that survived did in part by embracing sound. Like live-action films, the first sound cartoons had very few sound effects and everything was recorded in one take, usually after the film was produced. Instruments and sound props created most of the sound effects, often percussive in nature, or created by instruments such as slide whistles and xylophone bells. Early cartoons were often “musical” and frequently depicted characters dancing, singing, and playing instruments or props.

Max Fleischer was the first to experiment with the synchronization of sound and animation. He saw the potential in integrating sound and began working with Lee de Forest to create recorded soundtracks. The short, animated film series *Song Car-Tunes* (1924–27) were the first sound cartoons. Fleischer also invented the “follow the bouncing ball” technique used in the *Song Car-Tunes*, which visually indicated the rhythm of a song to help audiences sing along to the lyrics. A similar technique was later used by Walt Disney to synchronize sound and image. There were thirty-six titles in the *Song Car-Tune* series; seventeen were silent films accompanied by live music and nineteen were sound films, which used the Phonofilm sound-on-film process developed by de Forest. The first sound film from the series was *Oh Mabel* (Fleischer, 1924), produced some years before Paul Terry’s *Dinner Time* (Terry, 1928), and Walt Disney’s *Steamboat Willie* (Disney, 1928).

Fleischer brought *Koko the Clown*, *Betty Boop*, *Popeye*, and *Superman* to the screen and was also responsible for a number of technological innovations, such as the Rotoscope. Animated films were primitive and jerky to begin with, which was something that bothered Fleischer. Max got his brother Dave Fleischer to perform choreographed movements dressed in a clown costume. The live-action images were then projected onto a frosted glass panel and redrawn. World War I interrupted

Fleischer's work due to a stint producing training films for the U.S. Army. After the war ended, he returned to his *Out of the Inkwell* series with Dave, who had been working as a film editor at an army medical museum. The series proved popular with audiences and transformed animated films from being considered a "curiosity" into an industry (Fleischer, 2005). In 1921, Fleischer launched his own studio, Out of the Inkwell Inc. He improved on the Rotoscope with the Rotograph, which allowed an animated figure to be superimposed over a moving background. The Rotograph also made combining animation with live-action easier, which became a popular technique in early films, in the same way the combining of live-action and CGI is today.

### **Incorporating Sound**

The incorporating of sound integrated Max and Dave Fleischer's brother, musician Lou Fleischer, into the production team; he became the head of the Fleischer Studios Music Department. Cartoons during this era usually had wall-to-wall music and minimal dialogue, which was typically vocal sound effects such as grunts and groans. *My Old Kentucky Home* (Fleischer, 1926) was their first attempt at using synchronized dialogue, with a doglike character saying, "Follow the ball, and join in, everybody." The film was not very successful, but Max continued producing cartoons with dialogue, devising a new series called *Talkartoons*. The popularity of Walt Disney's Mickey Mouse also inspired the creation of a new character, Bimbo, who first appeared in the Out of the Inkwell series as a character called Fitz. The studio's sixth Talkartoon, *Dizzy Dishes* (Fleischer, 1930), required a female character, and as Bimbo was a dog, Max developed a half-dog half-female character that after refinements became Betty Boop. In *Dizzy Dishes*, Bimbo plays a chef who gets distracted by Betty Boop (before her doglike ears were revised) performing a "Boop Boop a Doop" on stage. While the story is simplistic, the animation and soundtrack were an improvement on *My Old Kentucky Home*, featuring more dialogue, sound, and Foley effects.





*Fig 1:23 Dizzy Dishes (1930, dir. Dave Fleischer). From Fleischer Studios*

Due to a lack of screen crediting and documentation, it's unclear who was responsible for the sound effects in Fleischer's early films, although there are two distinct possibilities, Max and Maurice (or Morris) Manne. Morris Manne appears with an effects credit in an Aesop's fable called *House Cleaning Time* (Terry, 1929). Max Manne is credited as "effects artist" on *Dinner Time* (Terry, 1928), an animated short film produced and directed by Paul Terry and codirected by John Foster. *Dinner Time* was one of the first publicly shown "all talking" sound-on-film cartoons. Max Manne also features in a *Popular Mechanics* (1927) magazine article entitled "*Expert in Noise Making Adds Joy to Theatregoing*". The article suggests Manne was the resident sound artist at the Roxy Theatre in New York. Scattered references imply he held a number of positions: production manager, drummer, sound effect device creator, and artist for theater, film, and animation productions.

To make as much noise as he can and in as many different ways as possible is the task of Max H. Manne, who produces sound effects to accompany the films and feature numbers at Roxy's theater. Wire brushes rubbed over the kettledrum, give the effect of a locomotive's noise; a reed whistle has been made to imitate an infant's cry; catgut, variously used, mimics the calls of a number of animals and to reproduce a dog's bark, a string drawn through a tin can and caressed by rosined fingers is effective. Mr. Manne has been granted a number of patents on noisemakers, and the percussion room of the theater, where articles are stored, is an interesting museum of musical novelties. (Popular Mechanics, 1927, p. 818)

### **Full Steam Ahead**

The soundtracks for *Dinner Time* and *House Cleaning Time* were rudimentary. Walt Disney criticized *Dinner Time* for being "a lot of racket and nothing else" (Disney in Barrier, 1999, p. 55). According to some sources, it was *Dinner Time* that actually inspired Disney to produce a better sound cartoon. His brother Roy O. Disney also cites the success of *The Jazz Singer* (Crosland, 1927) as a motivating factor in Disney's interest in sound. In 1927, Carl Laemmle from Universal Studios approached Disney requesting a new all-animated series featuring a rabbit. Disney and animator Ub Iwerks created Oswald the Lucky Rabbit. *Poor Papa* (Disney, 1927) was the first Oswald cartoon; it was criticized by producer and distributor Charles Mintz because Oswald looked too old. The second film, *Trolley Troubles* (Disney, 1927), featuring a younger version of Oswald, received positive reviews and launched the series. The first Oswald films were produced as silent films, sound effects were added later, and they were then re-advertised as sound films. Sound had quickly become an attraction and featured heavily in film and animation marketing materials. Facing ownership issues, and in collaboration with Ub Iwerks and Les Clark, Disney created Mickey Mouse to replace Oswald, who faded into obscurity. It wasn't until 2006 that the Walt Disney Company actually got the rights to Oswald back, and he returned in

Disney's 2010 video game, *Epic Mickey*, with a plot that parallels Oswald's real-world history. The first two Mickey Mouse cartoons, *Plane Crazy* (Disney & Iwerks, 1928) and *The Gallopin' Gaucho* (Iwerks, 1929), were produced as silent films and failed to gain a distributor. *Gallopin' Gaucho* was the second short and although completed in August 1928, Disney decided not to release it in favor of working on *Steamboat Willie* (Disney & Iwerks, 1928).

To help make Mickey stand out from other cartoons, *Steamboat Willie* was released with a postproduced synchronized soundtrack. Disney realized that sound effects and music could function narratively, so while the soundtrack was postproduced, it was actually conceived in preproduction. Preliminary ideas were discussed at a "gag meeting" and later Ub Iwerks created polished sketches with a synopsis of each scene beside the sketch. According to Wilfred Jackson, Disney either wrote the synopsis or proofed and finalized Iwerks's initial descriptions (Barrier, 2007). During the preproduction phase, a "bar sheet" was devised with each sound effect and musical measure linked to the screen action. Using a metronome and mouth organ, Jackson, who had some music knowledge, helped Disney time the action. Jackson prepared the rudimentary bar sheet and Disney devised exposure sheets indicating which frames the musical beats would fall on. The two documents were prepared before the animators started so that sound and image would work in synchronization. Disney wanted the film to feel real, and as if the sound was coming from what the characters were doing. While work was being undertaken on the rest of the film, a sequence was inked, painted, photographed, and put together for a test screening. Jackson played the mouth organ, Ub Iwerks banged on pots and pans, Johnny Cannon provided sound effects using various props, and Disney provided dialogue effects, namely grunts, laughs, and squawks. The screening proved successful, and once the film was completed, Disney hired a seventeen-piece orchestra and three sound effect artists for the soundtrack recording session.

Despite money being an issue at the time, Disney's insistence on marrying sound and

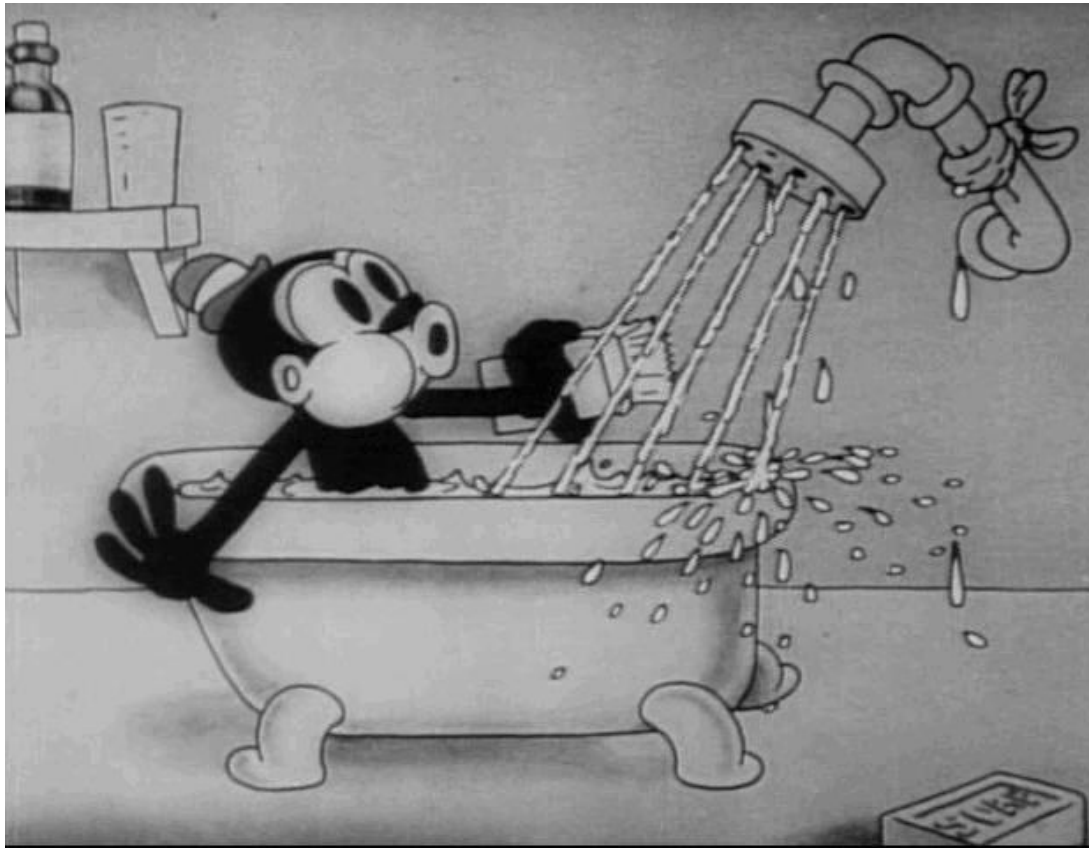
image as tightly as possible paid off. *Steamboat Willie* was recognized as “a real sound cartoon” instead of “a silent cartoon with an added soundtrack” (Barrier, 1999, p. 55). The film is considered Mickey Mouse’s screen debut, although it was not until *The Karnival Kid* (Disney & Iwerks, 1929) that Walt Disney first voiced Mickey. *Steamboat Willie* premiered in November 1928 and “the thing that hooked the crowds—was its sound” (Leslie, 2002, p. 21). Rave reviews for cartoons were unusual, but *Variety* magazine (1928) acknowledged that while it was not the first animated cartoon to be synchronized with sound effects, it represented “a high order of cartoon ingenuity, cleverly combined with sound effects” (Jenkins, 2014, p.105). Disney and his artists had made sound a part of the art of animation. Disney initially adopted the Cinephone system, which was rumored to be a pirated version of the RCA Phonofilm system. Patrick Powers, an American businessperson involved in the film industry, had hired a former de Forest technician to produce a cloned or similar version of the Phonofilm system, which became known as the Powers Cinephone. The former technician was Bill Garity, who ended up working for Disney as his special effects and sound technician. Garity later headed the department that helped extend the capabilities of the animated films. One of their key developments was the multi-plane camera, which gave depth to animated films and made it possible to create camera movements, which simulated live-action films. Another major development was “Fantasound,” an innovative stereo system installed in theaters for Disney’s classic, *Fantasia* (Alger et al, 1940), which was the first commercial film to be released in stereo. Fantasound was also a precursor to what is now known as surround sound. Fantasound created the illusion of movement across speakers by introducing the pan pot (panoramic potentiometer), which allowed sound to be panned with a left, center, and right speaker configuration. Increasing the volume during loud passages and reducing it during quiet ones also addressed the lack of dynamic range, which is the difference in volume between the loudest and quietest sounds in a soundtrack.

### **Synchronized Dialogue, Silence, and SFX**

A year after the release of *Steamboat Willie*, animators Hugh Harman and Rudolf Ising

created *Bosko The TalkInk Kid* (Harman, 1929), a live-action/animated short film produced as a demo to pitch a series of Bosko cartoons. Harman and Ising worked at Walt Disney's studio in Kansas City and later founded the Warner Bros. and Metro-Goldwyn-Mayer animation studios. Harman had considered producing a sound cartoon in 1927, with the intention of capitalizing on the coming of sound. He filmed *Bosko The TalkInk Kid* with a sound camera in a Hollywood recording studio. The film features live-action footage of Rudolph Ising drawing Bosko, who comes to life. The short is a landmark film in animation sound history because it was the first sound cartoon to use prerecorded dialogue as opposed to vocal effects, and it emphasized dialogue over music, which was unusual at the time. It wasn't released in theaters and was only seen by a wide audience when it was screened on Cartoon Network's television special *Toonheads: The Lost Cartoons in 2000* (Fitzgerald, 2000). *Sinkin' in the Bathtub* (Harman & Ising, 1930) was the first Warner Bros. theatrical short, the first of the Looney Tunes series, and Bosko's theatrical debut. It was also the first publicly released non-Disney cartoon to have a prerecorded soundtrack produced with the Vitaphone system. The film is presented as a musical cartoon and resembles *Steamboat Willie* in both story design and production process. The dialogue is minimal, although it does contain more dialogue than *Steamboat Willie*. Most notable is a deviation from wall-to-wall music and the accenting of certain gags with silence and sound effects.

By the early 1930s, the talkies were a global phenomenon, and even critically acclaimed silent films were playing to near-empty theaters. The silent film had become unviable. Theaters rushed to install sound equipment and studios built soundproof facilities. The soundtrack started to evolve quickly and became more clearly defined in terms of dialogue, music, and effects. The success of *Steamboat Willie* and the first live-action "talkies" motivated directors to start developing projects with sound in mind.



*Fig 1:24 Sinkin' in the Bathtub (1930, dir. Hugh Harman and Rudolf Ising). From Leon Schlesinger Studios*

## ADVANCING THE CRAFT

### Story, Design, Process, People

The second major development after “the coming of sound” was the introduction of color. The world’s earliest color film, only discovered recently, was actually shot in 1902 by Edward Turner, a little-known Edwardian photographer (Singh, 2012). The first sound cartoon photographed in two-strip Technicolor was “*Flip the Frog*,” who debuted in the short film *Fiddlesticks* (Iwerks, 1930). As a result, *Fiddlesticks* is considered a landmark in animation history. After a falling out with Disney, Ub Iwerks founded Iwerks Studio and created Flip. In the film, Flip is seen dancing across lily

pads and quacking like a duck until a tortoise he mistakes for a lily pad throws him into the pond. He swims ashore and joins a party in full swing. After performing a dance, Flip plays a duet with a mouse on violin (resembling Mortimer Mouse, the original Mickey Mouse). The mouse becomes infuriated by Flip's diminishing playing skills and clouts him with the violin. They resume playing and start dancing. As the music becomes sadder, the mouse starts crying. Flip also starts crying, which makes the piano cry. Flip starts stroking the piano, which kicks him, and Flip retaliates by beating the piano. While color was a novelty for audiences, Fiddlestick offered nothing new and garnered limited success. The film lacked cohesion and a plot, and adhered to what had become something of a cliché in pre-1930s sound cartoons, synchronization and syncopation of movement with music and mainly musical sound effects.



*Fig 1:25 Fiddlesticks (1930, Ub Iwerks). From Celebrity Productions*

The ongoing success of Mickey Mouse inspired Disney to forge ahead with the sound cartoon. He created the Silly Symphonies, which were designed to capitalize on

sound's capabilities. The *Silly Symphonies* series comprised seventy-five animated short films produced from 1929 to 1939 and won an Academy Award for Best Animated Short Film seven times. Disney also started to explore the use of color. *Flowers and Trees* (Gillett, 1932) was the first film to be theatrically exhibited in the full-color three-strip Technicolor process and won the first Academy Award ever given to an animated film. It was originally produced as a black-and-white short; however, after seeing some Technicolor tests and factoring in the public's interest in color films, Disney had the short redone in color. The film depicts trees and flowers coexisting in a tranquil environment, disrupted by the advances of an evil tree. A fight unfolds between the two male trees and the evil tree strikes back by lighting a fire. While singing and dancing was a cartoon cliché, the film also had a coherent narrative, which music and sound effects effectively support without overpowering the visuals.

### **Sound, Story, and Workflow**

*Flowers and Trees* (Jackson, 1932), *The Three Little Pigs* (Gillett, 1933), *The Tortoise and the Hare* (Jackson, 1934), *Three Orphan Kittens* (Hand, 1935), *The Country Cousin* (Jackson, 1936), and *The Old Mill* (Jackson, 1937) were all Academy Award winners. Disney realized that success depended upon telling emotionally engaging stories, and he established a story department, separate from the animators, with storyboard artists dedicated to working on story development. Disney also set up a sound effects department. Jimmy MacDonald was one of the first sound effects artists employed at Disney (Bonifer, 1985). He was a drummer in a band contracted to record music for a Mickey Mouse short in 1934. After the recording was over, Disney asked MacDonald to stay and help develop the sound effects department. Within two years, the sound effects team expanded to include five sound artists. The period signified a shift away from the dominant use of musical instruments to create sound effects in cartoons. The role became not just about inventing or finding the right sound effects but also required greater analysis of the film narrative and the editing of sound effects to pictures. The ability to record sound on film meant sounds could be assembled and cut into separate tracks, which made the role more complex and specialized.



As Disney cartoons became more detailed and lifelike, MacDonald designed and built custom sound props to create more detailed and lifelike sound effects. Disney gave the new department ample time to experiment with the creating of sound props and sound effect creation. A number of his devices mirrored and extended upon those used by Loutherboung in early theater, silent film, and radio drama. MacDonald had a major impact on the development of sound design as a distinct practice and has since been described as “the dean emeritus of sound designers” (Mancini, 1985, p. 364). He created hundreds of sound effect devices throughout the 1930s and an estimated 28,000 individual sound effects, resulting in one of the largest sound effects libraries in motion picture history. MacDonald’s techniques included the use of voice as a sound effect, editing and mixing prerecorded sounds, the manipulation of sound props, and performing sound effects live. Despite being responsible for some of the most familiar sounds in cinema between 1934 and 1977, MacDonald is not actually credited on many of the films he worked on. His first major credit was for *Snow White* (Jackson et al. 1937), which required years of preparation before it was released. In addition to creating sound effects and voicing Mickey Mouse, he also produced numerous other vocal effects.

During the mid-1930s, Walt Disney, composer Carl Stalling, and Jimmy MacDonald also streamlined their sound production processes (Strauss, 2002). Stalling devised a tick system, which was a precursor to the click track, a series of cues used to indicate exact timings for musicians to accompany films. The Disney team used a reel of unexposed film punched with holes, which created audible clicks and pops when the film ran over a projector sound head. The emergence of the storyboard and specialization of roles also influenced soundtrack production. Storyboard artists were assisting writers by giving visual shape to story ideas, and the use of dialogue in cartoons became more prevalent. While it had been possible to record dialogue on film in advance and then animate mouth movements to match, it was not until around 1934 that dialogue was “narrative” based. Previously dialogue was often tied to the

music, and usually rhymed, which made it nearly indistinguishable from lyrics and song. Animators worked with exposure sheets that broke the dialogue down into frames so they could animate mouth movements without even needing to hear the voices. However, post recording dialogue could (and can) result in voice, body, personality, and performance mismatches, if casting and directing are not thoroughly considered. On the other hand, recording dialogue in advance was (and can be) problematic if script and animation changes occur. Disney wanted more personality in his characters and had a tendency to favor the recording of dialogue early. According to his daughter, during the casting of Snow White he organized for a microphone to be installed on a sound stage connected to a speaker in his office so that he could only hear the auditions (Miller, 1956). His casting selections were not influenced by visual appearances, but by critical listening.

The first Silly Symphony to employ a significant amount of dialogue was *The Flying Mouse* (Hand, 1934). The film tells the story of a young mouse who fantasizes about flying. He attempts to fly using leaves as wings and is ridiculed by his family. He keeps trying, but his efforts are in vain. After a scolding from his mother, he hears pleas for help from a butterfly caught in a spider's web. The mouse fends off the spider and saves the butterfly, which turns out to be a fairy, and she grants him his wish to fly. The shadow cast by his wings when in flight gives him the appearance of a bat and he frightens his family into hiding. An outcast, he finds himself in a forest and is taunted by bats. Crying, one of his tears causes the fairy to return, and she removes his wings. The dialogue is not timed to the rhythm of music and therefore is more natural sounding. The sound effects are still quite sparse and fairly typical of early cartoons but also include organic and realistic sounds such as a bottom spanking and water. The score is narratively driven and overall there is a smoother and more dynamic balance between dialogue, effects, and music/song compared to earlier sound cartoons.

The next major development for Disney films was the multi-plane camera. The earlier success of *The Three Little Pigs* (Gillett, 1933) and *The Tortoise and the Hare* (Jackson, 1935) influenced Disney's decision to progress with development of the multi-plane camera and *Snow White* (Jackson et al. 1937), the first feature-length animated movie. Disney wanted to make cartoons more realistic, like live-action films, with greater depth and dimension. There was no way of creating successful tracking shots using traditional animation methods, and animating forward motion was time-consuming, therefore costly. *The Old Mill* (Jackson, 1937) was specifically designed to test the multi-plane camera, and it solved tracking issues by splitting a field of view into different planes. Separate levels were used for the foreground, middle ground, and background. For a forward-motion tracking shot, a more realistic effect was accomplished by moving foreground and middle-ground planes toward the camera, while the background plane remained stationary. The multi-plane camera could take up to seven layers of artwork (painted in oils on glass) mounted a foot or more apart and shot under a vertical and moveable camera. While a development like this might not seem significant for sound design, it parallels the depth and perspective potentials in both sound design and sound mixing. Sound designers and mixers consider depth and dimension in much the same way as visuals. *The Old Mill* was also developed as an experiment in the visualization of musical moods. According to the principal writer, Dick Rickard, the aim was to create the type of imagery that might be visualized while listening to a symphony or a concert (Barrier, 1999). Also significant for sound is the incorporating of lighting and color effects, representations of rain, wind, lightning, ripples, splashes, reflections, and 3D rotations of objects. VFX (visual effects) often go hand in hand with SFX (sound effects), and the greater the visual detail, the greater the aural detail. When considering the attention to both visual and sound design, *The Old Mill* is understandably considered the first Disney cartoon to be truly designed (Barrier, 1999). Critics described the film as poetic, which proved to Disney he had achieved the kind of depth he was aiming for.

The *Old Mill* depicts a community of animals living in an old abandoned windmill, and how they deal with a violent thunderstorm that nearly destroys their home. It opens with music and a shot of the mill. As the film progresses, sound effects and music interweave, creating the soundtrack. A single firefly circles a frog, which he gulps, causing his croaks to tinkle. The wind rises with a chorus of female voices. Reeds sway in the wind, and the frogs spooked by the wind leap into the pond and hide under a lily pad. Shutters bang in the wind as the windmill blades start to move. Inside the windmill a mother bird nesting in a sprocket hole is endangered by a fraying rope. Lightning strikes, thunder rumbles, and the rope snaps. The mother bird covers her nest as they are thrown under the wheel. Luckily, a missing cog saves them from being crushed. Roof slates are blown off as the rain intensifies. Pond reeds are battered against a broken gate, playing part of the score, and plant stems snap, becoming flutes. The storm and music intensify as the shutter smashes and the pace quickens, culminating in a crash of lightning. The inhabitants are knocked around inside until the savaged windmill slows to a stop. The image fades to black momentarily, transitioning to the next morning and life resuming. Leigh Harline, who composed more than fifty tunes for Disney, created the score, and MacDonald and his team created the sound effects (Bohn, 2017). There is no dialogue; therefore, the story is driven by the visuals, music, and sound effects. For rain sound effects, MacDonald lined the inside of a rotating drum with finishing nails nailed onto strips. Inside the drum were Mexican peas, and when it was rotated, the peas hitting the nails produced the sound of rain. The sound of a frog croak was created by bowing a taut string connected to a coffee can, a thunder sheet created the thunder and lightning, and a wind machine was used for the wind.

In 1937, Disney produced the animated feature film *Snow White* using the experience gained from the production of previous shorts. At the time, he was worried that short films would not keep the studio profitable. The cost of producing shorts was increasing, and double features were taking the place of short films being screened before features in theaters. The film industry was skeptical of his plans and predicted

*Snow White* would ruin Disney financially. The opposite happened. *Snow White* was a worldwide box office success and another landmark in the development of animation as an art form.

### **Looney Tunes**

Rival company Warner Bros. opted for producing *Looney Tunes*, a series of comedy shorts named after Walt Disney's *Silly Symphonies*. After adding animation directors such as Tex Avery and Chuck Jones and voice actor Mel Blanc, Warner Bros. created popular cartoon stars such as Bugs Bunny, Daffy Duck, Porky Pig, Elmer Fudd, Tweety Bird, Sylvester the Cat, Speedy Gonzales, Wile E. Coyote, the Road Runner, and the Tasmanian Devil. *Looney Tunes* and sister series *Merrie Melodies* became the most popular animated shorts at that time. A part of that success is attributed to Mel Blanc's ability to bring personality and life to characters through voice. Blanc began his career performing in radio before voicing Bugs Bunny, Daffy Duck, Porky Pig, Tweety Bird, Sylvester the Cat, Speedy Gonzales, and many other characters. He's had a vast repertoire of dialects, voice characterizations, and vocal sound effects and is regarded as one of the most influential people in the voice acting industry.

Tregoweth (Treg) Brown was another influential sound effect artist and was responsible for the sound effects in *Looney Tunes* and *Merrie Melodies* cartoons from 1936. He was not credited for his work until 1956 and was initially credited as "Film Editor." According to director Chuck Jones, the film editor credit also referred to the sound effects editor, but it's unclear as to whether this was common considering sound effects artists had been credited for sound effects decades earlier. Nonetheless, Jones described Brown as "one of the most brilliant sound effect editors that ever lived" (Jones in Furniss, 2005, p. 96). Prior to working in animation, Brown was a sound editor on Warner Bros. live-action feature films and one of the first people to enter the field of film sound editing. He worked with Cecil B. DeMille and won the 1965 Academy Award for Sound Editing for the classic comedy *The Great Race* (Edwards, 1965).

*Porky's Hare Hunt* (Hardaway, 1938) marked the first appearance of the rabbit that would later become known as Bugs Bunny. Mel Blanc voiced all the characters, Treg Brown created the sound effects, and Carl Stalling was the musical director. Combined, the trio had a substantial amount of experience in dialogue, sound effects, and music and came to dominate Warner cartoon soundtracks. The soundtrack, which had previously been fairly inconsequential, became one of the studio's greatest assets. *Porky's Hare Hunt* partly conforms to the binding of music to action and the use of instruments such as slide whistles and percussion as effects, but it also incorporates the mixing of real and realistic-sounding sounds, such as gunshots, Foley, and a mechanical toy rabbit. The combining of real and comedic sounds adds a sense of realism to the gags, while punctuating comedic moments. At times the music drives the action and at other times music and effects interplay to support the action.



*Fig 1:26 Porky's Hare Hunt (1938, dir. Ben Hardaway & Cal Dalton). From Leon Schlesinger Studios*

Treg Brown's approach to sound effects and comedy is most noted within discussions of Roadrunner cartoons. *Fast and Furry-ous* (Jones, 1949) was Wile E. Coyote and the Road Runner's debut and set the template for what later became a series. It was originally intended to be a one-off short film, but after favorable feedback from exhibitors a second film was produced. The premise of the series is a parody of chase

scenes involving two characters alone in the desert, one the pursuer (Wile E. Coyote) and the other the pursued (Road Runner). The hungry Wile E. Coyote tries to catch the speedy Road Runner through various schemes and traps. Neither character speaks, except for the “beep beep” of the Road Runner. Artist Paul Julian imitated a car horn sound he made when he was in a hurry, which was recorded and became the Road Runner’s calling card.

In *Fast and Furry-ous*, the characters are introduced and freeze-framed with text as a way of identification; Road Runner’s text description reads “Accelleratii Incredibus” and is marked with a beat of silence and a bell sound effect, before breaking into a dramatic slow-motion run with short skid sound effects coinciding with his feet contacting the road. Music also punctuates the motion; the skid sound effect is edited a fraction before the beat, allowing both music and sound effects to play at perceivably the same time even though they are marginally apart. There is a variation in pitch/frequency and level (volume) between sound effects and music so that one does not mask the other. The result is exaggeration; the event seems bigger and more dramatic than it is. As the Road Runner takes off, we hear zips, ricochets, and an aircraft sound effect, which are all sounds that indicate speed. The Road Runner is very fast. Wile E. Coyote is seen watching the Road Runner with binoculars. He half licks his chops and is freeze-framed as his text description reads “Carnivorous Vulgaris,” which is punctuated with a beat before the full chop lick is completed. This tells us Wile E. Coyote is very hungry and sets up what unfolds. Classic gags follow as he attempts to capture and eat the Road Runner. In a similar style to *Porky’s Hare Hunt*, sound effects and music score the action, which is essentially Wile E. Coyote’s painful inability to catch the Road Runner.



*Fig 1:27 Fast and Furry-ous (1949, Chuck Jones). From Warner Bros.*

### **Stop-Motion Film**

During the early 1930s, sound design experimentation also took place through the stop-motion feature *King Kong* (Cooper & Schoedsack, 1933). Murray Spivack at RKO (Radio-Keith-Orpheum) Pictures created the sound effects for the film and is recognized as one of the first sound editors to use sound in a creative way. Spivack was a professional theater and movie drummer; drum teacher and an innovative sound technician (Black, n.d). He started playing drums professionally at the age of twelve, and in the decade that followed became house drummer at the Strand Theater, an early movie palace in New York. Spivack was also a percussionist in the New York symphonic orchestra and specialized in recording music for silent films. He worked in radio and later opened his own drum teaching and recording studio. Spivak was one of the first drummers to play for conductor Josiah Zuro, who worked on scores for film and animation (Slowik, 2014). In 1929, Spivack moved to Los Angeles and managed the sound effects and music department at the RKO Studios, which is where he devised the sound effects for *King Kong*. He was a founding member of the Cinema Audio Society, and his contributions to the field of recording percussion led to his

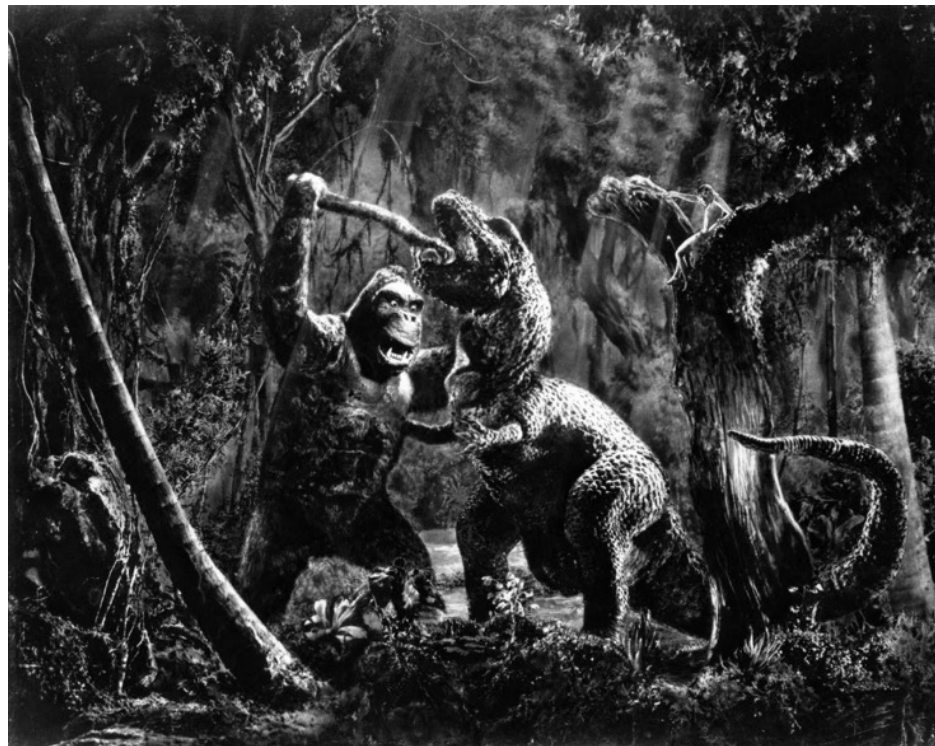


induction into the Percussive Arts Society Hall of Fame in 1991.

In 1975, *King Kong* (Goldner and Turner, 1975) was named one of the fifty best American films by the American Film Institute. The film is often hailed as the greatest classic adventure-fantasy film of all time and was a significant development in special effects and stop-motion animation. It also launched the “giant beast” or “giant monster” subgenre of science fiction. Audio technology was still quite limited around the time of production, and Spivack had only a vague idea as to how to create the necessary sound effects for Kong. He studied the script and itemized the sounds that needed to be created. Over a period of nine months, Spivack recorded and designed all the sound effects he had identified from the script. Spivack recorded zoo lion and tiger roars, which he edited together, played backwards, and slowed down. He rerecorded the effect, edited together the peaks of the sound, and added a tail so the roar would end naturally. This was due to the long duration of King Kong’s visual roar and because the original roars would be too familiar-sounding and lack the weight and depth of King Kong. For the scenes where Kong expressed affection, Spivak recorded himself grunting through a megaphone, pitched them down, and rerecorded them. He used a similar technique for animal cries and the Tyrannosaurus screeches. A bellows or pair of bellows, which is a device used for blowing on a fire to supply it with air, were used for monster breaths. The death rattle of the dying Tyrannosaurus was a mouthful of water gurgled through a megaphone. The sound of King Kong beating his chest was created through hitting Spivack’s assistant on the chest with a tympani stick while another assistant held a microphone to his back. Kong’s footsteps were a plumber’s friend (a plunger) on gravel. Spivak recorded a slapstick for the gunshots but later discovered that by removing half of the powder from a .22 bullet he could get a more realistic and controlled sound. Once the music had been completed, he then altered the pitch of the sound effects to compliment Max Steiner’s score.

The 1930s marked the beginning of a shift in approaches to soundtrack design. The

expression “mickey mousing,” apparently coined by producer David O. Selznick, is often used to describe the close synchronization of music to action and animated motions of the characters (Skweres, 2007). Max Steiner is frequently credited with inventing the technique, but Disney had been employing it since *Steamboat Willie* (Reay, 2004). Selznick felt that it was obtrusive and distracting and believed music should help the mood of the scene without audiences being aware that they are listening to music. He advocated for composers working with the script, rather than a finished film. Today the technique is considered a cliché and overused, although arguably it can still serve comedy well. The decrease in “mickey mousing” coincided with a general move from musically driven films to narratives with greater psychological depth. Consequently, dialogue, sound effects, and music became less constrained by synchronization with visuals, and vice versa.



*Fig 1:28 King Kong (1933, dir. Merian C. Cooper and Ernest B. Schoedsack). From RKO Radio Pictures*

## **TV KILLS THE RADIO STAR**

### **Realism, Limited Animation, and Stylized Animation**

Television became commercially available in the late 1920s; however, television sets were not commonplace until after World War II. As a new medium, television introduced new problems. Sound effects were not high on the list of priorities; picture and dialogue quality took precedence. Theaters were converted into TV studios with little attention to audio requirements, and some producers even considered sound effects the territory of radio, not television. However, as television became more popular, the demand for better-quality content increased. It was quite common for early radio dramas to be reworked as television dramas, but not all shows transferred across equally as well; sometimes the listener's imagination surpassed the quality of production and visuals. Shows were shot live, which meant major set changes had to occur during commercials. There was no such thing as a "second take." Transitions like time or scene changes were also problematic. In radio drama, sound and music could act as a bridge; film could be edited; and in theater, scene changes were customary and accepted by audiences. As competition between mediums increased, comparisons were also made between the higher production values in film, which led to some television directors complaining about the lower quality of television sound. Like today, television productions had smaller budgets and faster turnaround times compared to film. Despite a slow start, television production advanced quickly; it had the benefit of stage, radio, and motion picture production experience to draw from.

### **Bang Bang**

Guns and gun sound effects were especially problematic in early television shows. Audiences had been hearing Western and gangster films since the 1930s so had developed certain expectations. Film sound editors had the luxury of combining gun sound effects in postproduction to create bigger and more dramatic-sounding guns. Prior to the development of audiotape, record companies tried to solve the problem with realistic-sounding guns on sound effect records, but this made the cueing up of

gunshot sound effects difficult. If a second shot was required, then the sound effect record had to be cued again or a second record was needed. Records were produced with multiple shots, but this meant the timing of shots was predetermined and rarely matched or synchronized with the associated visuals. Guns and gunshots needed to look and sound realistic. Blanks caused a flame from the barrel, and the paper waddings holding the powder in the casing would shoot out. An alternative or compromise was to shoot pictures with an empty gun. The actor would turn his or her back to the camera and move as if firing while the sound effect artist manually performed the sound effect. A second alternative was to have the camera cut away from the actor. Both options were problematic, especially if the actor wasn't in the right position and the audience saw that the gun wasn't actually doing the firing.

Don Foster, a CBS sound effect artist and inventor, came up with another solution, which was a shot machine aptly named the "Foster Gun" and something of an early electronic "instrument." The Foster Gun could generate various gunshots, ranging from machine gun fire, antiaircraft fire, cannons, explosions, and ricochets (Mott, 1990). The right audio frequency could be manually selected, or the shot could be triggered by the sound of a blank firing. If the shots were off-screen, it was triggered manually, and if they were on-screen, the sound of a blank would trigger the sound effect. It was sensitive enough to pick up a quieter blank sound, while rejecting anything below a threshold, effectively functioning like a "Gate," a common plug-in used in audio production today. The downside was that a louder sound or another sound at the same frequency the machine was tuned to would also trigger the shot, which made tuning critical. The gunshot problem was eventually resolved in 1954 when two sound effect artists, Ray Kemper and Tom Hanley, recorded a series of real gunshots out on location for a television show called *Gunsmoke* (French & Siegel, 2014). Kemper and Hanley's gunshots rivalled those used in films and became an industry standard.

*Gunsmoke* was a Western that successfully migrated from radio to television and ran

for twenty seasons, from 1955 to 1975. The show featured U.S. Marshal Matt Dillon, who was responsible for Dodge City, a town in the Wild West. Norm Macdonnell, the producer, prioritized music and sound effects, or “exaggerated sound patterns,” as he called them (Dunning, 1998). The term is misleading because he was using it to describe the use of sound design narratively, as a replacement for dialogue and music. The show received critical acclaim due to its unprecedented realism and attention to detail, which was in part because of the focus on and approach to sound design.

*When Dillon and Chester rode the plains, the listener heard the faraway prairie wind and the dry squeak of Matt’s pants against the saddle leather. When Dillon opened the jail door, the listener heard every key drop on the ring. Dillon’s spurs rang out with a dull clink-clink, missing occasionally, and the hollow boardwalk echoed dully as the nails creaked in the worn wood around them. Buckboards passed [horse-drawn carriages], and the listener heard extraneous dialogue in the background, just above the muted shouts of kids playing in the alley. He heard noises from the next block, too, where the inevitable dog was barking. (Dunning, 1998, p. 305)*



*Fig 1:29 James Arness as Matt Dillon in the television version of Gunsmoke (1956). From CBS Television*

### **Limited Animation**

In 1939, W2XBS “telecasted” Walt Disney’s *Donald’s Cousin Gus*, directed by Jack King, which was the first prerecorded program and animated film televised as part of a show that also included music, songs, a film, and a play. *Donald’s Cousin Gus* was not made for television; animation was considered too expensive for broadcast, so animation studios wanting to enter the television market had to create more economical content. This resulted in the production of “limited animation.” Limited

animation reduced production costs by minimizing the use of synchronized dialogue, using walk cycles, keeping character bodies static when possible, and animating moving body parts on a separate level. Many felt that this reduced the quality of animation and led to Chuck Jones coining the term “illustrated radio.” Jones was referring to the simple visual style, which relied more heavily on sound to tell the story. A cartoon series called *Crusader Rabbit* (Ward, 1949) was the first animated series produced specifically for television and was broadcast on KNBH in 1950. *Crusader Rabbit* was a cliffhanger-styled adventure series featuring a white rabbit, which became quite popular and helped establish the made-for-TV mode of production. The animation and synchronized dialogue were minimal and the narrative driven largely by voice-over narration, with music and spot sound effects created by Ray Erlenborn and Gene Twombly. Twombly was an actor and created sound effects for several radio shows, including *The Jack Benny Show*. Erlenborn was a vaudevillian, voice actor, and sound effects artist. Prior to his involvement in sound, he played one of the newspaper boys in *Charlie Chaplin’s City Lights* (Chaplin, 1931) and appeared in the TV series *The Buster Keaton Show* (1950). He also created the animal sound effects for the original live-action musical film *Dr. Dolittle* (Fleischer, 1967) and voiced the rabbit from Walt Disney’s *Winnie the Pooh Discovers the Seasons* (Reinert, 1981).



*Fig 1:30 Crusader Rabbit (1949-57, dir. Alexander Anderson and Jay Ward). From Creston Studios, Jay Ward Productions, TV Spots*

In 1942, Disney animators Dick Moores and Jack Boyd formed Telecomics, Inc. and in 1945 created a pilot for a low-cost series, which led to the production of a television program consisting of four three-minute stories. NBC optioned the material in 1950 and renamed the series NBC Comics. There were 125 episodes, each featuring comic artwork (Roman, 2005). *Space Barton* (Telecomics, 1950) was one of the three-minute stories and stars Horace “Space” Barton Jr., a college football star who, after enlisting in the Army Air Corps, lands on Mars in a rocket ship with his stowaway brother Jackie. Mars is experiencing a civil war and Space Barton is pitted against a group led by a deranged Earth scientist who preceded them to Mars. The production style is similar to that of *Crusader Rabbit* except pared right back to mostly static images, a voice-over, and a few spot sound effects, which gives the film the appearance of a storyboard with a voice-over (or a story reel).



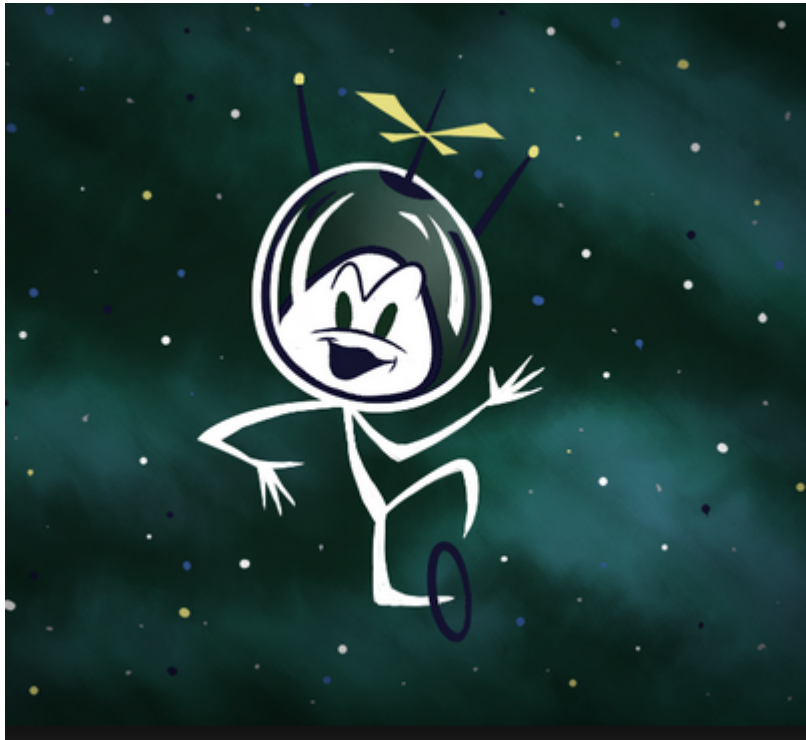


*Fig 1:31 Space Barton (1950). From Telecomics*

### **Stylized Animation and Sound Effects**

In 1957, former Metro Goldwyn Mayer (MGM) animation directors William Hanna and Joseph Barbera and live-action director George Sidney formed Hanna-Barbara. Their first involvement in television was *Colonel Bleep* (Buchanan & Schleh, 1957), the first animated series produced specifically for color television. Futuristic, stylized, but still in the domain of limited animation, the series takes place on Zero Zero Island, which is where Earth's equator meets the Greenwich Meridian. Colonel Bleep is an extraterrestrial life form from the planet Futura, with the ability to manipulate "futomic energy" and propel himself through space or use it as a weapon. His "space deputies" are a mute cowboy puppet boy called Squeek, representing the present day, and a Caveman awakened from a sleep of several thousand years, representing the past. The trio's main nemeses are Dr. Destructo, the Black Knight, and Black Patch,

a space pirate. Each story is predominantly told through narration and sound effects, and it's possibly the first, or one of the first, animated series to use electronic sound effects, predating television shows like *The Jetsons* and *Futurama*.



*Fig 1:32 Colonel Bleep (1956-57, dir. Robert D. Buchanan and Jack Schleh). From Soundac*

Huckleberry Hound was Hanna-Barbera's next television cartoon and premiered in 1959, *The Flintstones* following in 1960. Hanna-Barbera also produced the first television special to combine live-action with animation, *Jack and The Beanstalk* (Kelly, 1967). Alongside their cartoons and characters, they developed a reputation for their sound effects library, which was largely developed by Fred McAlpin through the production of *Tom and Jerry*, short slapstick films that center on the rivalry between the two main characters, Tom the Cat and Jerry the Mouse. The films are known for their non-gory (aural and visual) violence and won seven Academy Awards for Best Short Subject (Cartoons). According to Hanna, their sound effects library

preexisted their MGM days. Prior to creating most of the sound effects for MGM, Fred McAlpin worked for Harman and Ising Studios and took the library to MGM, and when Hanna and Barbera left MGM, they took the library and expanded on it. Hanna described McAlpin as a “true pioneer” who built and collected sound props, which included everything from dishpans to whistles (Hanna, 1995, para. 4). Some of their most famous sound effects include a rapid bongo drum used for a character’s feet scrambling before taking off, tires squealing for a sudden stop, a bass drum and cymbal mix for a fall, and a xylophone being struck rapidly for a tiptoeing effect. Short theatrical film studios, both live-action and animation, were falling into decline by the 1950s. This was partly due to a decrease in film audiences in favor of television. Hanna and Barbera realized early on that sound effects were just as important in television animation as they were in full or theatrical animation, so despite budget restraints, they always factored in sound effects. In the late 1960s, they launched the short-lived Hanna-Barbera Records and released a series of L.P (long-playing) records, which contained some of the classic sound effects. In 1993, Fred Seibert, the last president of the studio, commissioned sound effects company Sound Ideas to release a digitally remastered, four-CD set version entitled *The Hanna-Barbera Sound FX Library*, which features many of their original sound effects. Many other studios and production houses have been using these effects for decades.

*Gerald McBoing-Boing* (Cannon, 1950) also used classic cartoon sound effects, except in *Gerald McBoing-Boing*, sound effects are his dialogue. The story was written by Dr. Seuss and previously featured as an audio story on a children’s record in the late 1940s. The film was adapted by Phil Eastman and Bill Scott, directed by Robert Cannon, and produced by John Hubley from United Productions of America (UPA). In 1943, Hubley formed a studio with former Disney animators Stephen Bosustow, David Hilberman, and Zachary Schwartz. Hubley wanted to experiment with new styles of animation and break away from the overt realism developed by Walt Disney. Realism was aesthetically limiting and UPA wanted to explore the use of caricatures rather than lifelike representations. *Gerald McBoing-Boing* tells the

story of Gerald McCloy, who at the age of two begins “talking” in sound effects. As Gerald grows up, his speaking in sound effects intensifies, earning him the nick-name of “Gerald McBoing Boing.” After angering his father, the distraught Gerald decides to run away but is stopped by a talent scout from the NBC Radio Network, who hires him as a sound effect artist. The film proved to be a major step in the development of limited animation. Some likened the design to art movements such as abstract expressionism and the style, pacing, and editing to the French New Wave films of the late 1950s and early 1960s (Butler, 2007). Similarly, the more prominent use of sound effects furthered the abstract and design quality of the film. *Gerald McBoing-Boing* won an Oscar and later became *The Gerald McBoing Boing Show* (1956–58).



Fig 1:33 *Gerald McBoing Boing* (1950, dir. Robert Cannon). From United Productions of America [UPA])

In summary, sound design is an old field; sound has always been used as a storytelling device. As films became more narratively complex, the importance of sound became more apparent, making the selection of the sound palette as important as the selection

of images, and the practice of sound design evolved into a specific discipline. Sound became integral, a key selling point, and a way of differentiating work. The development of limited and stylized animation furthered the interest in soundtrack design, not only in terms of economical filmmaking but also as part of a film's narrative and aesthetic. Despite negativity around limited animation, the basic process is very similar to the way story reels or animatics can be created for films today. With a greater sense of *audiovisual* history, designers and content creators can use and integrate historical practices to inform contemporary practices.

### **Graham – Micro Short (online)**

Graham extends on the concept of limited animation, the use of animation and sound to *pre-auralvis* a story idea, and low-cost filmmaking techniques. The synopsis is, *in a world where systems fail, and time struggles to pass there is but one hope in the bloody war between man and the machine – Graham.*

*Graham* was conceived as 60 second “audiovisual” test to introduce Graham as part of intended short form series pitch. The clip served as a vehicle for experimenting with a visual and sonic style that compliments a non-dialogue dependent approach to short form narrative. Graham is essentially a digital puppet, his semi 2D look is achieved through a specific rendering technique, and is a “play” on, and with notions of power and control. Like millions of people around the globe, Graham hates his job. He's cornered in “the cubicle of his own mind”, which manifests as a series of ‘episodes’.



*Fig 1:34 Graham (2008, dir. Paul James).*

The overall goal was to create a tactile, dirty, “punk rock” cartoon feel, as opposed to the cleaner, modern animation or “Pixar” look. The office girls are 2D, and another “play” on secondary characters/roles as irrelevant. The clock was conceived as an additional “character” (a comedic “antagonist”), reflecting the central theme and general subtext; 9-5 cubicle life, technology, the rise of “bullshit jobs” and failing systems, cumulating in an “explosive” release from Graham.

The online clip repeats, starting with a full mix, then isolating the various soundtrack stems. Sound is exaggerated to reflect subtext and punctuate certain visual aspects, the tap of his fingernails on the desk, the computer beeps draw the eye to the “restoring of the system”, the ticking of the clock coincides with the impatient tap of the finger, the clock hands “scrape” as time struggles to pass, acting as catalyst for Graham to

turn to the clock, pounding and compounding his reality, before being drawn back, by sound, to his computer failing again, prompting him to head butt the machine. The script was also devised to explore mix dynamics, it starts quiet and ends loud, and in consideration of being viewed/listened to on a mobile phone with headphones. The process was collaborative and iterative, which helped with timing, dynamics, and overall pacing.



## CHAPTER 2: SOUND AS DESIGN

Early film and sound technology opened the door to more than just the synchronization of sound with image. Sound-on-film processes encouraged artists to experiment with graphic-sonic art, animated, hand-drawn, and ornamental sound. The short film lent itself to audiovisual experimentation and provided a vehicle for filmmakers to explore the creative use of sound. Experimental compositional techniques such as *musique concrète* were particularly influential in the evolution of sound design practice. Film movements like the French New Wave, the science fiction genre, and art house films also determined the need for a more stylistic approach to soundtrack design. Methods employed by contemporary sound designers are diverse and multifaceted, but they draw from very similar sound-sculpting techniques pioneered by earlier artists.

### EXPERIMENTS IN DESIGN

#### Short Films and Sonic Art

Arseny Avraamov was a Russian composer, journalist, music theorist, and inventor. He was involved in the production of the first Russian sound films, led a sound laboratory at the Cinematic Institute of Scientific Research, and lectured on the history and theory of sound at the Moscow Conservatory. Among his many achievements was the invention of graphic-sonic art, a technique that created sound by drawing onto the optical soundtrack of film. While working on *The Plan for Great Works* (Room, 1930), Avraamov, inventor Evgeny Sholpo, and animator Mikhail Tsekhanovsky noticed the “ornamental” nature of variable-width film sound. Engineer Eric Humphriss, who had previously worked on RCA’s Photophone sound-on-film technology, later demonstrated the reproduction of the first “synthetic” voice. He analyzed the sound wave patterns that corresponded to phonetic components of voice recorded on film. In 1931, Humphriss painted a waveform to create the phrase “all of a tremble” on a strip of cardboard, which he photographed onto film (Levin, 2003).



Around the same time, a number of other artists were also creating sound by drawing or photographing patterns on film. German animator Oscar Fischinger experimented with “sound ornaments” and Rudolph Pfenninger with hand-drawn “music.” Fischinger used graphical icons to create sounds and in 1932 demonstrated how the parameters of pitch, time, and amplitude interact to create a composite optical waveform. Among the first generation of artists to adopt these new ideas were Len Lye, Harry Smith, Jordan Belson, and Norman McLaren.



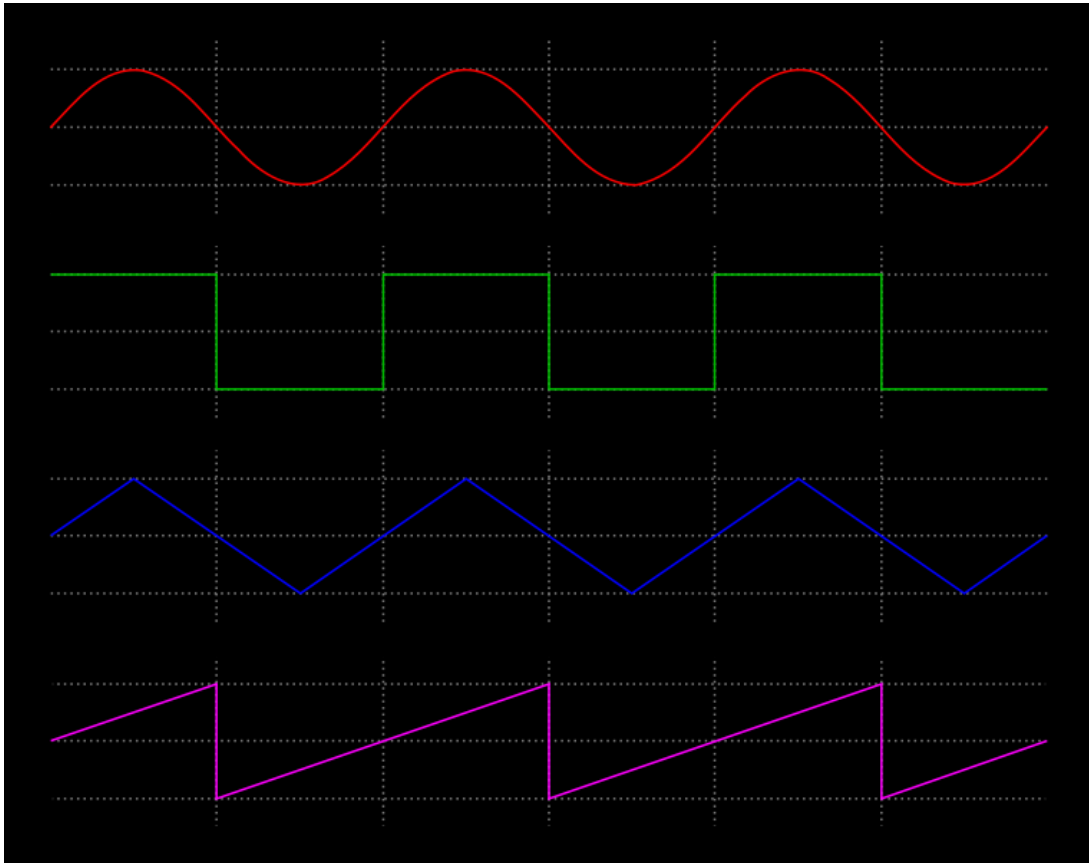
*Fig 2:1 Ornament Sound Experiments (1932, dir. Oscar Fischinger)*

### **Sound Cards**

Canadian filmmaker Norman McLaren produced the award-winning *Neighbours* in 1952, using live actors as stop-motion objects and a soundtrack created by what he called “animated sound.” In documentation of his work, McLaren describes three methods of creating sound using film: painting or inking directly onto blank film, scratching into black film, and photographing film “soundcards,” a technique that he adopted and advanced. He created a library of one-inch by twelve-inch strips with one to 120 repetitions of hand-drawn sound wave patterns to reproduce every semitone across a five-octave range. The drawings consisted of a basic figure or shape repeated to form a patterned band, which resulted in a series of sound waves having a definite tone or color. Using simple and easily drawn shapes, he also made new kinds of sound waves. The drawings were photographed in the same way animated films were shot. One drawing was placed in front of the camera and one frame of film was taken. Then

the first drawing was removed and replaced with another drawing, and so on. The cards were photographed on the narrow vertical strip normally reserved for the soundtrack. After the film was developed and run on a sound projector, the photographed images of the drawings were reproduced as sound.

On some cards, the basic figure was repeated about four times within the card area to produce a low pitch. Twenty to thirty repetitions created mid-range pitches and high-pitched notes, as many as 120. To produce notes of a very low pitch, the cards were shot twice as fast and in the process of re-recording onto magnetic tape the audio was slowed down by half, which resulted in an octave drop. As a film camera shoots by the frame as opposed to continuously like sound recording equipment, the soundtrack was built up from small units, each one twenty-fourth of a second in duration. If a longer duration note was desired, several successive frames of the same card were shot, building up a sustained effect by rapid repetition of the same note. For a very short note, one or two frames were used, and for rests or pauses, a black card was photographed. By photographing combinations of sound and black cards for varying lengths of time and at varying speeds, pitch and rhythm could be controlled. McLaren's drawn patterns relate to the four different types of basic waveforms (sine, square, triangle and sawtooth) in audio synthesis, and this is why the term "synthetic" sound is often used to describe the results. Figure 2:2 depicts the basic audio waveforms and is fundamental to understanding sound generation.



*Fig 2:2 The basic audio waveforms*

McLaren's experimental film *Synchromy* (1971) was produced through photographing square wave cards. It was created in three parts, shot on separate strips of film, rerecorded, and then mixed on magnetic tape. McLaren controlled the volume by varying the width of the soundtrack through a moveable shutter. Almost closed, the extremely narrow band of striations would give a pianissimo (very soft) note, and when the shutter was wide open, the broad band of stripes would produce a fortissimo (loud) note. After photographing the cards, McLaren used an optical printer to reproduce the sequence of shapes, which were colorized. Since the shape of the soundtrack opposite a single frame of film is a long, narrow column and the visual frame is rectangular, up to eleven columns side by side were used in the picture area.

The visual image, whether one or several columns, was the image of the original sound card used to create the corresponding sound. No “color-sound-theory” was applied, although the quieter passages are muted hues and louder passages more highly saturated. The production process and resulting effect allows the audience to see the shapes that generated the soundtrack.



Fig 2:3 *Synchromy* (1971, dir. Norman McLaren), National Film Board of Canada

### Rated X

In 1953, UPA released *The Tell-Tale Heart* (Parmelee, 1953), an adaption of a short story by Edgar Allan Poe (1843) and considered a classic of the Gothic fiction genre. Designed by Paul Julian (the artist who had previously voiced Road Runner’s “beep beep” at Warner Bros.), the grim tale fuses elements of surrealism with expressionism, and explores creative sound and visual design. It was a major departure from *Gerald McBoing-Boing* and the first cartoon in film history to be rated “X.” While considered a flop when released, it was nominated for an Oscar and is now listed as one of the fifty greatest cartoons of all time.

The story is told “through the eyes of a madman,” an unnamed first-person narrator voiced by British actor James Mason. The narrator attempts to convince the audience he is sane while describing a murder he committed. He qualifies his actions by claiming he suffers from a nervous disorder causing an over-acuteness of the senses. His victim is an elderly man. While he professes to care for the old man, he declares a hatred for his milky white, staring eye. The eye is blamed for his murderous intent. The narrator plots to murder the elderly man, insisting that his careful planning proves his sanity. Every night he sneaks into the old man’s room to observe him. On the

eighth night, while the narrator is watching the old man sleep, the old man is disturbed by a sound and wakes. The narrator remains still as the old man sits in bed, frightened. A dull pounding is heard, which the narrator interprets as the old man's terrified heartbeat, as if the old man suspects something is about to happen. The heartbeat gets louder and faster, which drives the narrator to kill the old man and hide the body beneath the floorboards. A knock at the door reveals the police have arrived, alerted by a neighbor who heard a scream. The narrator explains it was his scream while having a dream. The police enquire as to the whereabouts of the old man and the narrator tells them he is away in the city. As the police are about to leave, he invites them to stay for tea. In the process, a cup is dropped and smashes on the floor, drawing his attention to the floor, and he starts to hear something. At first, he thinks it's a clock ticking, but when the sound gets louder and deeper, he recognizes it's the heart of the old man, pounding away beneath the floorboards. He starts to panic, believing that the police must also hear the sound. As the sound gets louder, he cracks and admits to the murder. The final shot reveals the narrator in a prison cell.



*Fig 2:4 The Tell-Tale Heart (1953, dir. Ted Parmelee), United Productions of America (UPA)*

The soundtrack is as experimental as the pictures, especially for the period, with specific sounds integral to the narrative; the beating heart is a catalyst for murder. The film starts with a bell tolling on an exterior shot of the house, which cross-fades into a sinister musical score composed by Boris Kremenliev. The narrator opens with, “True I’m nervous, very very dreadfully nervous, but why would you say that I’m mad,” which is the central theme and repeated in the final scene. The film is set in a house where light, shadows, and shifting geometric planes appear, as if a metaphor for the narrator’s conflicted psychological state. The color palette is muted and the narrator depicted in silhouettes, shadows, and a textural image of eyes staring. The offending eye is described as having a milky white film, which is a reoccurring visual motif that links the eye with other imagery; branch-like broken capillaries, a moon, a milk jug that smashes, and cracks in a mirror all reflect the narrator’s obsessive hatred of the eye.

The narration leads the sound mix, underscored by music, which combined with tempo, pacing, and level changes creates dramatic tension. Music interplays with the shifting light and what the narrator implies, emphatically and sub-texturally. The soundtrack builds to breaking points using sound effects to heighten the tension and mark changes in the narrator’s mood and psychological state. Momentary pauses in narration and the use of silence create dynamics and a sense of recognition; the narrator knows he’s giving too much away, exposing his questionable state of mind. Foley effects are used sparingly, as subtle effects: footsteps, the creaking of a door, the movement of floorboards, the rustle of the bed, a clock ticking, fluttering of paper birds. The Foley is “real” and organic, which contrasts with the sound of the pounding heart, despite being organic by association (with a human heart). Black frames focus the audience on the act of listening, mirroring the narrator, who is hiding in the dark listening to the house, waiting for the right time to murder the elderly man. The heartbeat starts on black, intercutting the beat with a textural image suggestive of an internal organ. As the beat grows stronger, the image is intercut with a fast zoom; the editing quickens as the beat gets louder and faster, with the narration matching in pace

and energy. The sequence climaxes with the murder, a combination of Foley effects and abstract imagery, which cuts to black and silence, before fading up on the old man's hand and strewn bedcover. The effect is a "graphic" murder, yet nothing is actually seen; the image and Foley effects imply that the old man is beaten or possibly strangled. The narrator pulls the bedcover over the body and calmly states that it is over: "The heart was still...the eye was dead...I was free." As he rejoices in his freedom, music punctuates the word "free" as we see the moon whole and the house without walls, implying a freedom that entails giving in to madness. With a creaking of floorboards, the narrator acknowledges there is still work to be done—concealing the body. The creaking preempts his preconceived plan to hide the body under the floor. Again, like the murder scene, the audience does not witness the act but sees the hole in the floor, which dissolves to reveal the hole boarded up. A clock strikes four (a.m.) and there is a knock at the door, heard while the narrator, in a point-of-view (POV) shot, reviews his handiwork. Panning, he turns to the direction of the knocking and the front door. The following sequence splits into his POV, intercut with the reoccurring textural image of eyes staring, as if he is both watching himself and feeling under scrutiny, being watched.

There is an undercurrent of paranoia and suspicion throughout the film. As the police investigate the house, their dialogue is treated with reverb, which alludes to spatial reality, the adding of room reverb, and subtext, in the form of a hollow, soulless emptiness. The narrator, sounding desperate, asks the police to stay for tea, and in such a way that insinuates he wants to get caught. He describes the hour as "wretched" and says, "It would surprise good people how much evil the night conceals from their eyes." A cup spilling water as it smashes on the floor acts as another aural-visual motif, a catalyst for the film's resolve, the narrator admitting to the murder. The cup and saucer are white, like the filmy eye and the moon. The narrator, while attempting to downplay the incident, also draws attention to the floorboards. He starts to hear an imagined heartbeat on an overlaying image depicting a drop of water causing ripples. Believing the police must also hear the heartbeat but are pretending otherwise, the

narrator is tortured by the sound. As the beat grows louder and more insistent, he screams his guilt and reveals the body wrapped in the bedcover under the floor. The final shot fades up from black to a metal jail door with the narrator's line of dialogue from the opening, treated with room reverb, with a metallic edge, as it would sound inside a jail cell. We hear a door slam, cut with his hand on the door, as if while acknowledging he's been locked up, he still considers himself sane. Through bars in the door, we see what looks like a prison as the sound of the door slam echoes through the space.



*Fig 2:5 The Tell-Tale Heart (1953, dir. Ted Parmelee), United Productions of America (UPA)*

### **Now Hear This!**

On a much lighter note, Looney Tunes experimental cartoon *Now Hear This* (Chuck & Noble, 1962), was also nominated for an Oscar. In the style of limited animation, the film experiments with the combination of sound, image, and text. Treg Brown's



exaggerated sound effects are coupled with animation and graphics to tell the tale of Satan's misplaced horn. The film opens with the title forming and sound effects playing with the concept of onomatopoeia. The "OW" says "ow" and is hit by the "N" to create "NOW." The "HE" laughs itself on screen, and when joined with a monkey screeching "AR," forms "HEAR." The "THIS" sounds like a train and the quotation marks are deflating balloons. A worried and confused Satan then appears, minus one of his horns. After he wanders off, the title splashes into an ocean, which a boat chugs across, then is sucked down a "plughole." Music and sound effects combine to create a cacophonous graphic credit sequence, until an unseen voice yells for quiet. Silence follows, in silence and text, which evolves into a parody of the "follow the ball" animation technique, with music, effects, and the voice of Bugs Bunny. A man appears with a horn-shaped hearing device, footsteps crunching, and discovers Satan's misplaced horn. He inspects it with an eyepiece, which is punctuated with an exaggerated sound effect of scraping glass. He coughs. Perceiving the found horn as superior, he throws his into a trash can, opened by a bodiless leg and accompanied by a number of nonsensical sound effects. At first the man hears music through the horn, but then he experiences a series of aural and visual hallucinations that become increasingly bizarre; a bug sounds like a train; chickens cackle; a butterfly "toots"; a bird sings like a music box and walks into the horn; he hears "patterns"; a phone rings and becomes a shower; laughter and bubbles erupt; a little man dries himself loudly in a bubble; he gets run down by a train; he hears his own beating heart; he hears traffic; shots are fired; horns sound; a car appears and disappears with a "zip"; the little man reappears, takes the horn, and attaches it to a phonograph; the record is "sprung" and the little man shoots it; it rains; an umbrella becomes a rocket ship; and it all culminates into a gigantic explosion of sound and text. The battered man retrieves his original horn from the trash, and Satan reappears in a blaze of fire and reattaches his missing horn.



Fig 2:6 *Now Hear This* (1962, dir. Chuck Jones and Maurice Noble), DePatie-Freleng Enterprises (DFE), Warner Bros.

### **Mixing It Up**

Award-winning Czech filmmaker and surrealist artist Jan Švankmajer started making films in the 1960s when the “Czech New Wave” was gaining ground in the film industry. Švankmajer’s films combine live action, puppets, collage, drawn animation, montage, stop-motion animation, and sound, giving life to everyday and unusual objects. Švankmajer made his first short film, *The Last Trick of Mr. Schwarcewalldes and Mr. Edgar*, in 1964. The film depicts two stage performers attempting to outdo each other through various stage tricks for an unseen but audible audience. The opening title sequence combines mixed media visuals with titles, song interrupted with sound and Foley effects, which punctuate the opening credits. The film then introduces the two main characters with music, returning to the mix of song and effects, some musical in nature, which are used to punctuate the actions of the characters, in a non-sensical, non-literal fashion. The two characters continue interacting with the same audio treatment, which gets faster, and then returns to a more musically driven segment, combining score with percussive sound effects. The following shots depict a “fish” followed by one of the characters “opening his head” exposing internal mechanics, mirroring the percussive sounds heard previously. The fish are then thrown into the head, which is shut with the foley and sound effects of a trash can closing. A bug crawls from his ear and a socket wrench is inserted and wound, like a mechanical wind-up toy. This sequence intercuts between the action and the mechanical inner workings, driven by music and percussive, mechanical, motor and metallic sound effects. A fish is removed, devoid of any flesh, as if it has been eaten by the machine inside his head. It is tossed aside, and he rubs his stomach. The other character applauds the “act” and begins his act, which centers around playing a violin retrieved from inside his head, and a tightrope performance. After each act, the performers congratulate each other with a handshake, but as the competition heats up, the relationship becomes tense. The last trick is a disappearing act; the two performers make themselves disappear by tearing each other to pieces. The film mixes live action with puppetry and stop-motion animation. The soundtrack

is a blend of music, song, sound, and Foley effects, typically percussive in nature, which coincide with montage sequences and fast cutting between images.



*Fig 2:7 The Last Trick of Mr. Schwarcewalde and Mr. Edgar (1964, dir. Jan Švankmajer), Josef Soukup*

Švankmajer's third film, *A Game with Stones* (1965), opens with the sound of a ticking clock on a close-up textural image of an old wooden door. The door creaks open into what appears to be an empty room. The sound of the clock ticking is juxtaposed with pans and tilts of room details: the corners, dirt, and cracks in the wall. The ticking slows prior to a reveal of a clock, the source of the sound. The camera zooms in and cuts to a fast montage of clock mechanisms, with comb and pins from a music box, a tap, and a bucket. The clock strikes twelve and two stones "pop" out of the tap into the bucket. A montage of stone images follows: black stones on white stones, black stones on white backgrounds, and vice versa, stacked in different arrangements, which dance to the sound of the music box. The montage cuts as the bucket tips the original two rocks onto the floor. The sequence repeats, with more stones, which are interspersed with flashes of meat. Again, the stones are tipped out of the bucket, and the sequence repeats with even more elaborate stone arrangements, people and hands, skeletons and feet. The sequence repeats, except this time the stones become gravel. The final sequence is another repeat, but without the clock ticking, only a chime. The stones collide and crack apart, causing the bucket to break, and the stones fall to the floor. The last sequence is another repeat except the stones fall through the broken

bucket to the floor. The music plays but the stones are inanimate, and the clock ticks but makes no sound.

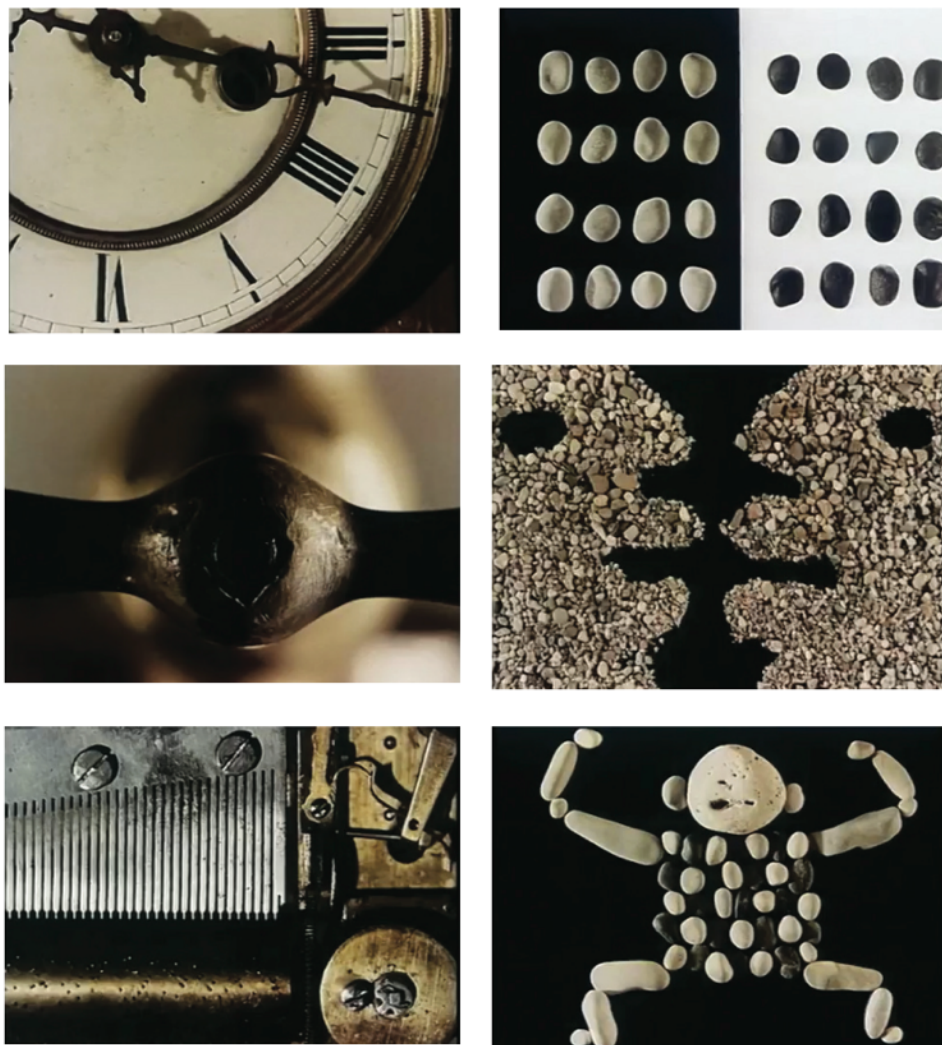
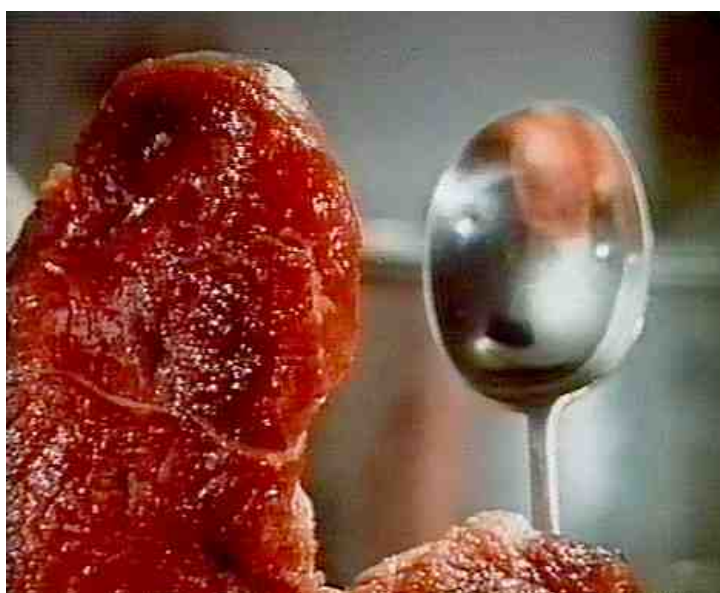


Fig 2:8 *A Game with Stones* (1967, dir. Jan Švankmajer), Studio A See

In *Meat Love* (1989), a 1-minute short film, Švankmajer further humanizes the inanimate. In a kitchen, we hear a café atmosphere and walla (background conversation of the diners). A knife chops two slices of fresh meat. We hear the slices and meat fall organically, yet exaggeratedly. The first slice “walks” over to a glass

and picks out a spoon. We hear the clink of metal contacting glass. She admires her reflection as the second slice groans into life. He “walks” over to her and expresses his admiration for her reflection with a slap on her rump. She lets out a little cry and drops the spoon to hide shyly behind a tea towel. We hear the spoon hit the table and the sound of cloth being draped around a body. The second slice switches on a radio and beckons her to dance. The meat slices dance and then jump into a plate of flour, writhing ecstatically until being skewered and sizzled in a frying pan. The soundtrack is dialogue effects (groan, cry), atmosphere (café), walla (which means the background “chatter” of people, in this film, in a café), Foley (cutlery, impacts, slaps, drops, walks), sound effects (sizzling), and source music (the radio).



*Fig 2:9 Meat Love (1989, dir. Jan Švankmajer), Koninck Studios, MTV Productions, Nomad*

### **Aural Junk**

David Lynch was also experimenting with abstract short films during the 1960s. His first film, *Six Men Getting Sick* (1966), was a one-minute animation that consisted of six loops depicting six people getting sick. It initially screened as part of a mixed-

media installation, accompanied with the sound of a siren. His second film, *The Alphabet* (1968), reflected the fear of learning through the use of animation and live action. After the success of *The Alphabet*, Lynch made *The Grandmother* (1970), which revolves around a boy who grows a grandmother to escape neglect from his parents. *The Grandmother* was also Lynch's first collaboration with Alan Splet, who sound designed all his films through to *Blue Velvet* (1986).

Lynch and Splet planned to use sound effect records to create the soundtrack for *The Grandmother*, but they found them unsuitable. Lynch had also developed an interest in counterpointing picture with atmospheric and exaggerated sound rather than realistic sound effects. So instead of relying on records, Lynch and Splet spent several weeks creating their own sound and sound design effects. The raw audio used in the film included pencil sharpeners, plungers, and various items of "junk" from a machine shop. They also experimented with adding effects such as reverb to a whistle. At the time, they didn't have access to reverb devices, so they used aluminum heat ducting with a speaker on one end and a microphone on the other, blew the whistle, and rerecorded the result a number of times.





*Fig 2:10 The Grandmother (1970, dir. David Lynch), American Film Institute (AFI)*



The soundtrack for *The Grandmother* was essentially created from “found” sounds either left intact, layered, or processed, creating an audio collage that emotionally charges the visual images. “Audio expressionism” is a way of describing the same approach to sound for image, recognizing the nonliteral aspects of sound design. Expressionist art attempts to convey emotion and meaning as opposed to reality, and often in a distorted, manipulated and exaggerated way.

I tend to amplify what you see on the screen. . .to heighten the picture by sort of interpreting what ´s there. The sound may or may not correspond with the visible movements of the things on screen. Instead, it kind of adds to it to create a mood, an atmosphere. (Splet in Gentry, 1984, p. 62)

The film resulted in Splet being offered a position running the sound department for the new American Film Institute (AFI) Center in Los Angeles, joined by Lynch, who became a fellow. While at the AFI, Lynch conceived his debut feature film, *Eraserhead* (1977). A surrealist horror film shot in black and white, it tells the story of Henry Spencer, a printer on vacation who suffers strange visions and hallucinations. The opening sequence depicts “The Man in the Planet” moving levers in his home in space, while Spencer’s head is seen floating in the sky. A worm-sperm-like creature emerges from Spencer’s mouth and floats into the void and he silently screams. The primary setting for the film is a bleak industrial neighborhood with imposing factories and thick pipes blowing steam. It’s a wasteland, devoid of life, yet machinery rumbles, clangs, creaks, and groans; a dog barks; a freight train passes; and music drifts in the air. Spencer returns home to a shabby one-room apartment with a single window facing a brick wall. His neighbor tells him that his girlfriend (Mary X) has invited him to dinner with her family. The dinner is an uncomfortable and awkward event. Henry is confronted with Mary’s deranged and dysfunctional parents, a catatonic grandmother, and a small man-made roast chicken that gushes blood. The

dialogue exchanges are banal and tense, and the situation takes an even stranger twist when it is revealed that Mary has just given birth to a premature baby. She and Spencer are married and start living together in his apartment. The infant is beyond deformed, a grotesque bundle with an inhuman, alien-like head. It refuses to eat and cries incessantly, driving the sleep-deprived Mary back to her parents' house. Henry is left to care for the sickly creature and begins experiencing visions. He sees "The Lady in the Radiator," who performs to organ music on an old-fashioned stage while squashing worm-sperm-like creatures as they drop onto the stage. Later Mary returns and in a fitful sleep with the bedclothes wrapped around her, like a straightjacket, she clicks her mouth and rubs an eye, which sounds hideous. The scene becomes even more grotesque when Spencer discovers the worm-sperm-like creatures are in the bed. Later a knock at the door leads to an encounter with the neighbor and another vision. The Lady in the Radiator sings, and a large chicken is wheeled in. Spencer literally loses his head, revealing a stump that resembles the creature-child. His head sinks into a pool of blood and lands on a street below, where a young boy collects it and takes it to a pencil factory to be made into erasers. Spencer, who has an encounter with the neighbor, sees her with another man and is crushed. For the first time, he removes the baby's bandages to find the baby has no skin. Spencer cuts into the creature's organs, which foam with a strange substance. The power in the room overloads and the child grows to huge proportions. As the lights burn out, the planet from the film's opening sequence replaces the child's head, and Spencer is seen in a billowing cloud of eraser shavings. The side of the planet bursts and the Man in the Planet is seen struggling with his now-sparking levers. The final sequence depicts The Lady in the Radiator embracing Spencer.

*Eraserhead's* foreboding mood and visual aesthetic is enhanced by both the abstract and organic nature of the soundtrack. By re-pitching and re-editing recorded (found) sounds employing techniques similar to those used by earlier *musique concrete* artists the sound design becomes part of the decaying architecture, the dread and anxiety. There have been a number of attempts to explain the film's meaning. The most

common view is a take on the perils of domesticity; however, according to Lynch, no interpretation of the film has matched his personal vision, and as an abstract work, it is open to interpretation. Critics have also deciphered Henry as a stand-in for Lynch, and the film a manifestation of the fear he experienced while living in Philadelphia in his early twenties. While *Eraserhead* was actually filmed in Los Angeles, Lynch has described it as his own *Philadelphia Story*, “a dream of dark and troubling things.” The sound design reflects exactly that and serves as a way of drawing the audience into Spencer’s world.

Sound is 50 per cent of a film, at least. In some scenes, it’s almost 100 per cent. It’s the thing that can add so much emotion to a film. It’s a thing that can add all the mood and create a larger world. It sets the tone and it moves things. Sound is a great “pull” into a different world. And it has to work (with the picture)—but without it you’ve lost half the film. (Lynch, 2003, p. 52).

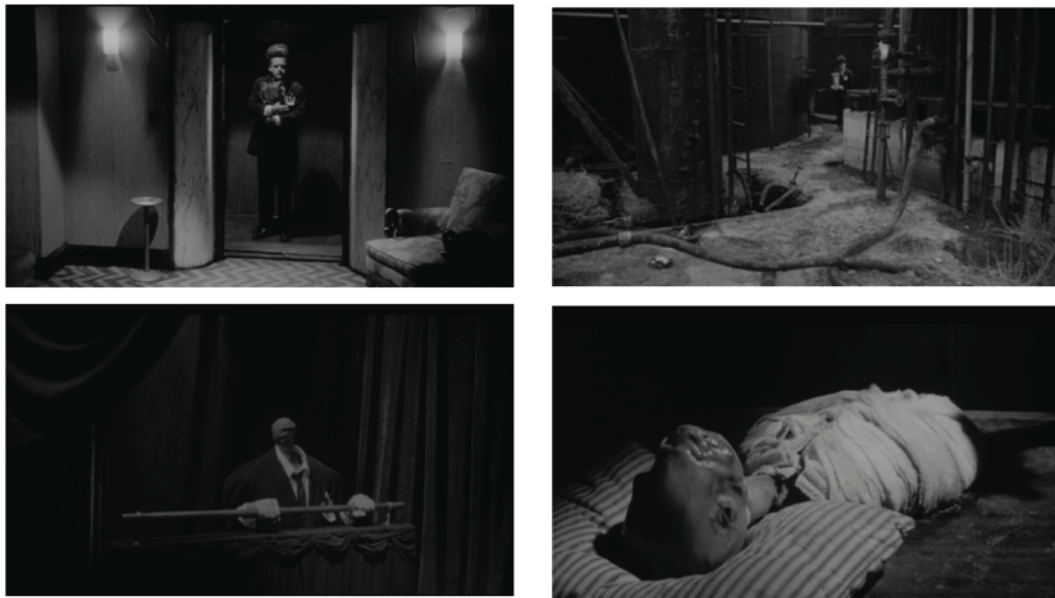


Fig 2:11 *Eraserhead* (1977, dir. David Lynch), American Film Institute (AFI), Libra Films

## THE ART OF NOISE

### **Sonic Sculpturing**

Another area that influenced the practice of sound design is experimental music and sound art. Early sound art was largely influenced by developments in magnetic tape and audio recorders. Danish inventor Valdemar Poulsen invented the telegraphone between 1898 and 1900, which recorded sound by electromagnetism. It consisted of a cylinder wrapped with magnetic wire and a recording head that revolved around the cylinder, magnetizing the wire. The telegraphone was later refined by German-Austrian engineer Fritz Pfleumer, who used a magnetic stripe as an alternative to wire. In 1935, he built the world's first practical tape recorder, called the Magnetophon. The use of magnetic tape for sound recording revolutionized the broadcast and recording industries. Tape gave artists the ability to record and rerecord audio with an acceptable loss in quality. In 1955, Louis Mackenzie introduced the cartridge machine and "carts" that were loaded with quarter-inch tape and adopted by broadcasters. Cartridge machines came in banks, which meant sound effects could be played separately and together. Magnetic tape was also a key technology in early computer development, allowing data to be stored and rapidly accessed. The introduction of tape was also integral to the development of experimental sound practices such as *musique concrète*

### **Musique Concrète**

"Musique concrète" is a French term for "concrete music," a composition technique that uses recordings of "real" (concrete) sounds as the raw material for the creation of experimental music. *Musique concrète* challenges traditional music and music theory: It is not governed by customary parameters such as harmony but by recorded sounds that are separated from their origin and manipulated. The fundamental principle of *musique concrète* is in the selection, recording, assembly, and manipulation of found sounds, or "sound objects," to produce a montage of sound.

French composer and writer Pierre Schaeffer developed the techniques involved in the production of *musique concrète* in 1948 while working at the Studio d'Essai (Experimental Studio). The studio was part of Radiodiffusion Française (RF), the French radio system created during World War II as a resistance hub for broadcasters. Despite coming from a musical family, Schaeffer had no formal music training, and his main interests were literature, philosophy, and technology. In 1942, Schaeffer convinced RF to make him the project director of research into the science of musical acoustics. He was among the first to manipulate and combine recorded sounds, as opposed to instruments, to compose music. Instead of notating musical ideas, he collected and manipulated concrete sounds. Schaeffer believed that traditional music starts as an abstraction, or musical notation, which is produced as music. The concept underpinning *musique concrète* is the reverse or inverse; it starts with “concrete” sounds and then abstracts them into a composition. Schaeffer (1948) considered music to be “patterned sound” and believed compositions could be created by juxtaposing and manipulating preexistent sound. Natural sounds, both animate and inanimate, could be altered and combined in a musical fashion. Schaeffer also believed that “playing” was another important part of the creation process, which is reflected in the improvisational nature of his work.

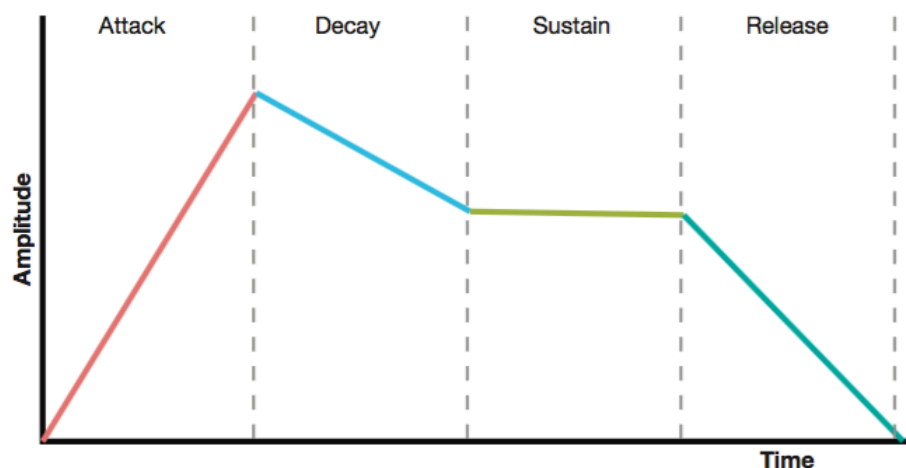
I have coined the term *Musique Concrète* for this commitment to compose with materials taken from “given” experimental sound in order to emphasize our dependence, no longer on preconceived sound abstractions, but on sound fragments that exist in reality and that are considered as discrete and complete sound objects, even if and above all when they do not fit in with the elementary definitions of music theory (Schaeffer, 1948, p. 14).



*Fig 2:12 Pierre Schaeffer, INA, Contributor, Getty Images*

Initially Schaeffer concentrated on sounds other than those produced by traditional musical instruments. Schaeffer experimented with alarm clocks, bicycle horns, birdcalls, bits of wood, clappers, coconut shells, klaxons, rattles, vibrating metal strips, whirligigs, bells, and trains to create his compositions. After raw sounds were recorded, they were isolated and then rerecorded with different treatments. Schaeffer later found it was possible to remove the familiarity of musical instruments and abstract them through techniques such as removing the attack of the sound or altering the envelope of a sound. After removing the percussive attack from bells and extending the sound through volume manipulations, he recognized that entirely new sounds could be created. Schaeffer also discovered that sounds could be classified by timbre and volume changes over time (what is now known as the “envelope”). Timbre

became as important as pitch had customarily been in music composition. Figure 2:13 depicts an ADSR envelope.



*Fig 2:13 ADSR envelope*

Schaeffer believed that sounds should be appreciated for their abstract timbral characteristics and not their source, cause, or context. He classified sounds in terms of their psychological effect on the listener. New recording and playback technologies and their ability to present “acousmatic” experiences inspired much of Schaeffer’s work. Acousmatic (or *acousmatique*) sound is sound heard without seeing an originating cause and is derived from the Greek word *akousmatikoi* (or “listeners”), which refers to pupils of Greek philosopher Pythagoras. Pythagoras demanded that students listen to his lectures while he was concealed behind a curtain. He believed this would focus the students on the content of his lectures. Schaeffer argued that the “inscrutability of sound—its representational and ontological ambiguity”—could be rectified through recording technology; by separating sound from its origin or source, the listener would focus on the sound in itself. He manipulated sounds in a way that prevented the listener from identifying their original source.

By 1948, Schaeffer had also learned how to lock-groove (or loop) sounds using records. Instead of a disc with a spiral groove that went toward the center of the disc, there was a single or a series of circular grooves that would play as a continuous loop. This involved placing an intentional skip in the record so a sound would repeat, which is similar to a tape loop or a sequencing and looping audio today. Using seven to eight turntables playing individual sounds or loops, Schaeffer created various sound montages. He composed *Etude aux Chemins de Fer (Study in Locomotives)* from the sounds of locomotive trains recorded at the depot for the Gare des Batignolles in Paris. The composition was derived entirely from sounds of steam whistling, trains accelerating, and compartments moving over rails. Schaeffer based his compositions on natural sounds, although a synthesizer does appear in later works, such as *Etude aux Sons Animes (Study on Animated Sounds)*. His process was not dissimilar from the work of Splet and Lynch, the collection and manipulation of found sound.

The introduction of audiotape resulted in experimentation with techniques such as tape looping and splicing. Other common practices included playing sounds backwards, editing sounds to become shorter or longer, filtering out or boosting certain frequencies, adding effects such as echo and reverb, and altering the original pitch of a sound. Schaeffer and engineer Jaques Poullin also created the Phonogene, which was able to transpose a tape loop in twelve distinct steps from a keyboard. The keyboard selected one of twelve capstans of different diameters, and a two-speed motor was used for octave transposition. The Morphophone was another invention, a specialized loop deck with an erase head, record head, and ten playback heads with adjustable filters for each to create special timbre effects. Throughout his career, Schaeffer also mentored other composers, including French synthesist Jean-Michel Jarre, who regards Schaeffer as an important influence in his work. Today Schaeffer's techniques are recognized as a precursor to contemporary sampling and sound design practices.



## A Manifesto

Many of Schaeffer's ideas were drawn from and similar to those of Luigi Russolo, a futurist painter regarded as one of the first experimental "noise-music" composers. Russolo designed and constructed a number of sound-generating devices or experimental musical instruments called *Intonarumori* ("noise intoners"). In 1913, he authored a manifesto called *The Art of Noises (L'arte dei Rumori)*, which is considered one of the most influential texts on twentieth-century music aesthetics. Futurism was an international art movement founded in Italy in 1909, and a futurist was someone who studied the future and made predictions based on current trends. It was an offshoot of cubism, initiated by Filippo Marinetti, an Italian writer and author of the *Futurist Manifesto* (1909). At the forefront of futurist painting was a fixation on motion, speed, noise, and machines. Futurist painters introduced time or temporal dimension to their paintings and produced pictures analogous to chronophotography, an early photographic technique that captures movement in several frames of print. In *Dynamism of a Car*, Russolo conveys the idea of motion with the compression of sound waves in front of a car, which resembles the Doppler effect. This is the effect heard when a sound source, such as a car or train, passes by and the pitch changes: It becomes higher as the sound approaches and lower as it passes. It was named after Austrian physicist Christian Doppler (1803–53), who theorized that sound waves from a moving source would be closer together as the sound came closer and farther apart as the sound went farther away. He proved his theory in 1842 by having trumpet players standing on a train pass by at varying speeds.

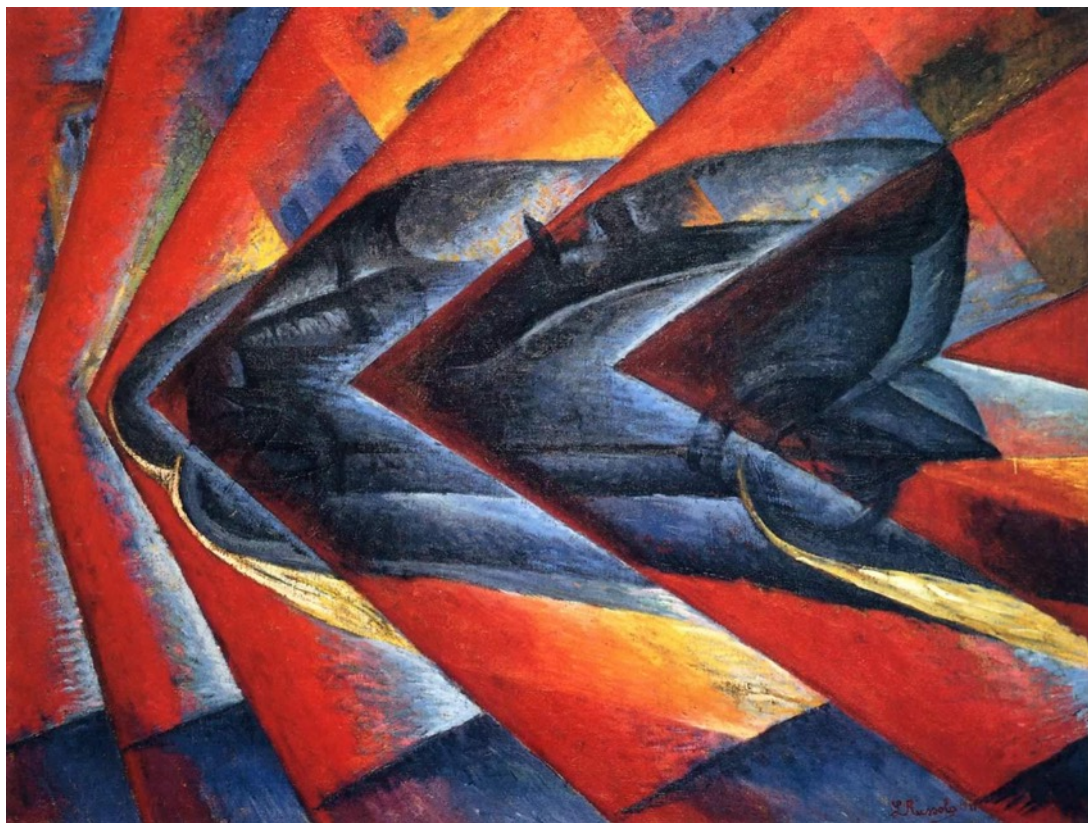


Fig 2:14 Luigi Russolo, *Dynamism of a Car* (1912–13) © Luigi Russolo

Russolo's ideas were similar to Marinetti's, whose *Manifesto of Futurism* called for a total revision of aesthetic values. Marinetti favored modernity and technology and developed a poetic technique while working as a war correspondent in the Italo-Turkish War in 1911. He used onomatopoeia in an attempt to liberate the sounds of poetry from the restrictions of grammar and syntax. The sounds of machine guns, bombs, and shrapnel become new words, which he called "noise poetry." *The Art of Noises* was also written as a futurist manifesto. Prior to writing the manifesto, Russolo had worked purely in the graphic arts domain. He later abandoned the graphic arts and turned his studio into a workshop for making the *Intonarumori*. Like Marinetti's, his manifesto advocated for a new approach to music composition. At the time, he was drawing parallels between the evolution of music and the proliferation of machinery, which he saw as a creative opportunity. For Russolo, orchestral instruments were

limited in the range of timbres they produced, and he believed technology would allow musicians to create an infinite variety of timbres. He claimed music had reached a point where it no longer had the power to excite or inspire; it lacked the more complex polyphony, tones, and coloring of organic and industrial sounds:

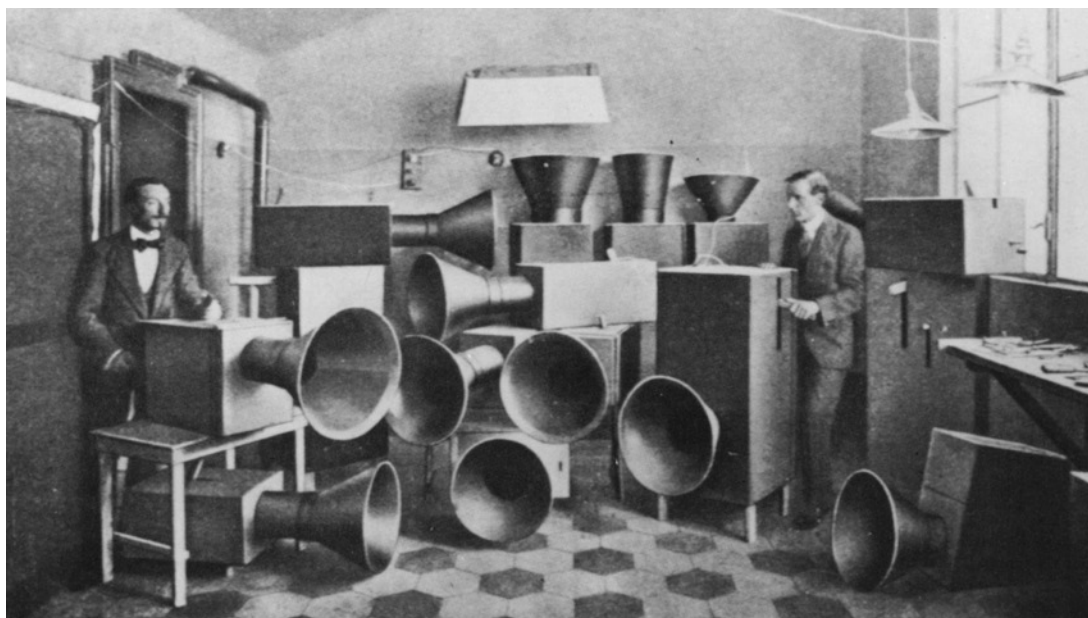
In the pounding atmosphere of great cities as well as in the formerly silent countryside, machines create today such a large number of varied noises that pure sound, with its littleness and its monotony, now fails to arouse any emotion (Russolo, 1913, para. 3).

Russolo predicted the future of music was in the way sounds could be combined to create new sounds. He considered the rhythmic movements of a sound as infinite possibilities and divided “noise” into six groups, which would form the fundamental building blocks or sonic palate for a futurist orchestra:

- Roars, Claps, Falling Water, Driving, Bellows
- Whistles, Snores, Snorts
- Whispers, Mutterings, Rustlings, Grumbles, Grunts, Gurgles
- Shrill Sounds, Cracks, Buzzing’s, Jungles, Shuffles
- Percussive Noises using metal, wood, skin, stone, baked earth etc.
- Animal and human Voices, Shouts, Moans, Screams, Laughter, Rattling’s, Sobs

Russolo claimed his new orchestra would produce “the most complex and newest sonic emotions” through “a fantastic association of these varied sounds.” He believed this new orchestra would attract “futurist ears as it already has futurist eyes” (Russolo, 1913, para. 23). Russolo concluded that this new sound would require instruments with “special mechanisms” capable of altering the pitch of a sound through built-in resonators and other types of extensions. He built the *Intonarumori* to

create and perform the music outlined in the *Art of Noises*. It's believed he was greatly influenced by the work of Leonardo da Vinci (1452–1519), who had previously experimented with acoustics and the design of mechanical instruments. Leonardo's instruments share commonalities with Russolo's designs; drums with cranked beaters, drum-box apertures, and integrating cones as tuned resonators. The Intonarumori were acoustic devices with varying types of internal constructions designed to produce different sounds. They had a drum skin attached to a string or coiled wire spring and a wheel acting as a continuous bow. The wheel rattled or bowed the string, while the drum skin functioned as an acoustic resonator. Sound was tuned by the tension of the string and the drum skin. Turning a crank generated sound, and a lever controlled the pitch of the sound. The wheel type, materials, positioning, string or spring, and pressure on the wheel defined the timbre of sound. The skin and the cone, similar to a gramophone, amplified the sound. One of the devices was described as a *burster* (or *scoppiatore*) and produced a sound similar to an early automobile engine. Other designs included a *hummer*, which sounded like an electric motor; a *rubber*, which produced a metallic scraping sound; and a *crackler*, which sounded like a cross between a mandolin and a machine gun. The Intonarumori were first presented at a press concert at Milan's Casa Rossa, the headquarters of the futurist movement in 1913.



*Fig 2:15 Russolo's Intonarumori, Hulton Archive, Stringer, Getty Images*

### **Sculptors of Sound**

Another pioneering figure in *musique concrète* and experimental music is Pierre Henry, who worked with Pierre Schaeffer at the Studio d'Essai from 1949 to 1958. During that time, he composed the first *musique concrète*-styled composition to appear in a commercial short film, *Astrologie ou le miroir de la vie* or *Astrology or the Mirror of Life* (Grémillon, 1952). After completing formal musical studies, Henry began his career as a percussionist, yet he aspired to create something new, strange, and unheard of. His work includes numerous collaborations with poets, dancers, filmmakers, and bands. Henry defined *musique concrète* as comprising movement and rhythm and being more connected to photography, cinema, and literature than traditional music. He aspired to conceiving a score like a film, with sound and voice.



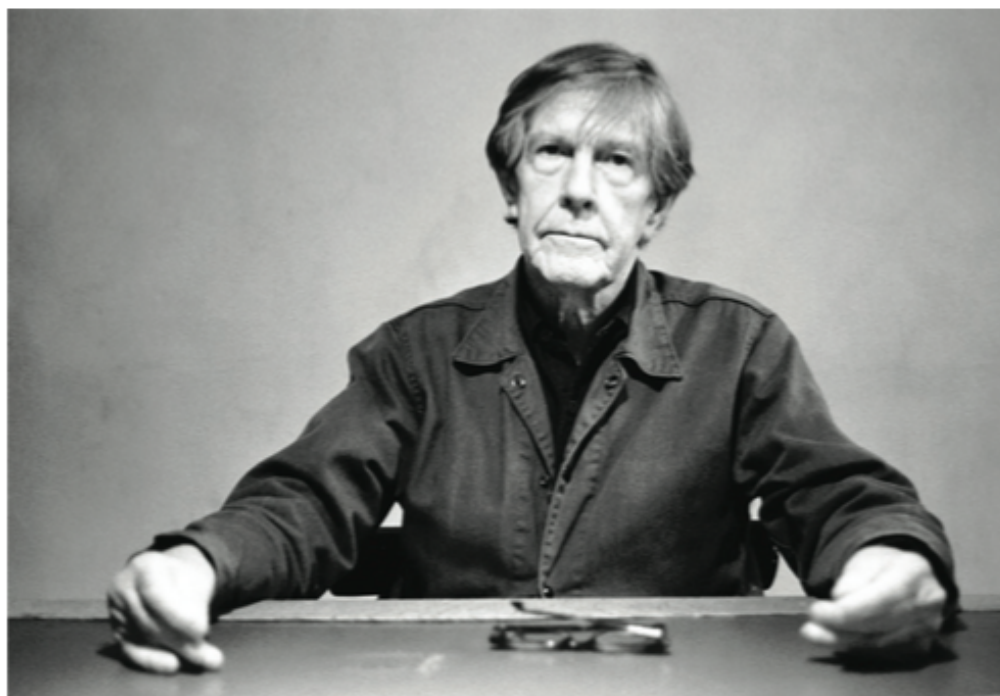
*Fig 2:16 Pierre Henry, INA, Contributor, Getty Images*

Daphne Oram, a pioneering British musique concrète composer, or “the mother of electronic music,” as she became known, cofounded and directed the BBC’s Radiophonic Workshop in the late 1950s. Oram started out as a junior studio engineer and “music balancer” at the BBC in 1942 and began experimenting with tape recorders and “synthetic” sound. She was promoted to music studio manager, and after a trip to the RTF studios in Paris, campaigned for the BBC to provide electronic music facilities for composing sounds and music. Oram and colleague Desmond Briscoe established the BBC Radiophonic Workshop in early 1958, where she was the first studio manager. After leaving the BBC, Oram set up her own studio in Kent and

worked on designing soundtracks for radio, television, theater installations, exhibitions, and short films, including electronic sound effects (uncredited) for Jack Clayton's horror film *The Innocents* (Clayton, 1961). She was awarded two grants from the Gulbenkian Foundation to support the research into "Oramics." Her Oramics machine was essentially a prototype synthesizer, and she had a very clear vision of how the computer would revolutionize electronic music. Oramics allowed a composer to draw "an alphabet of symbols" on paper and feed it through a machine that would in turn produce sounds on magnetic tape. The first drawn sound composition using the machine, entitled "*Contrasts Essonic*," was recorded in 1968, and in the 1980s, Oram worked on the development of a software version of Oramics for the Acorn Archimedes computer. In 1972, she published *An Individual Note of Music, Sound and Electronics*, a book that discusses her work and views on sound, music, electronics, and synthesis.

Another seminal figure associated with musique concrète is experimental composer John Cage, who is probably best known for 4'33'' (*Four Minutes, Thirty-Three Seconds*), composed in 1952 for any instrument or combination of instruments, with performer(s) instructed not to play their instrument during the entire duration of the performance. The controversial piece is commonly perceived as four minutes and thirty- three seconds of silence. Cage's intention was to redefine the concept of silence, because of the rarity of silence, or the total absence of sound. Cage believed silence was simply the absence of intended sound, which is how "silence" is used in film soundtracks. He studied music but realized that the kind of music he wanted to create was very different from music at the time. His early works were largely percussive and included elements such as pipes and sheets of metal, apparently inspired by a meeting with German abstract animator Oskar Fischinger. He was also inspired by artist Marcel Duchamp, who presented everyday objects in museums as "found art". Cage also experimented with recording technologies and the alteration of instruments.





*Fig 2:17 John Cage, Frans Schellekens, Contributor, Getty Images*

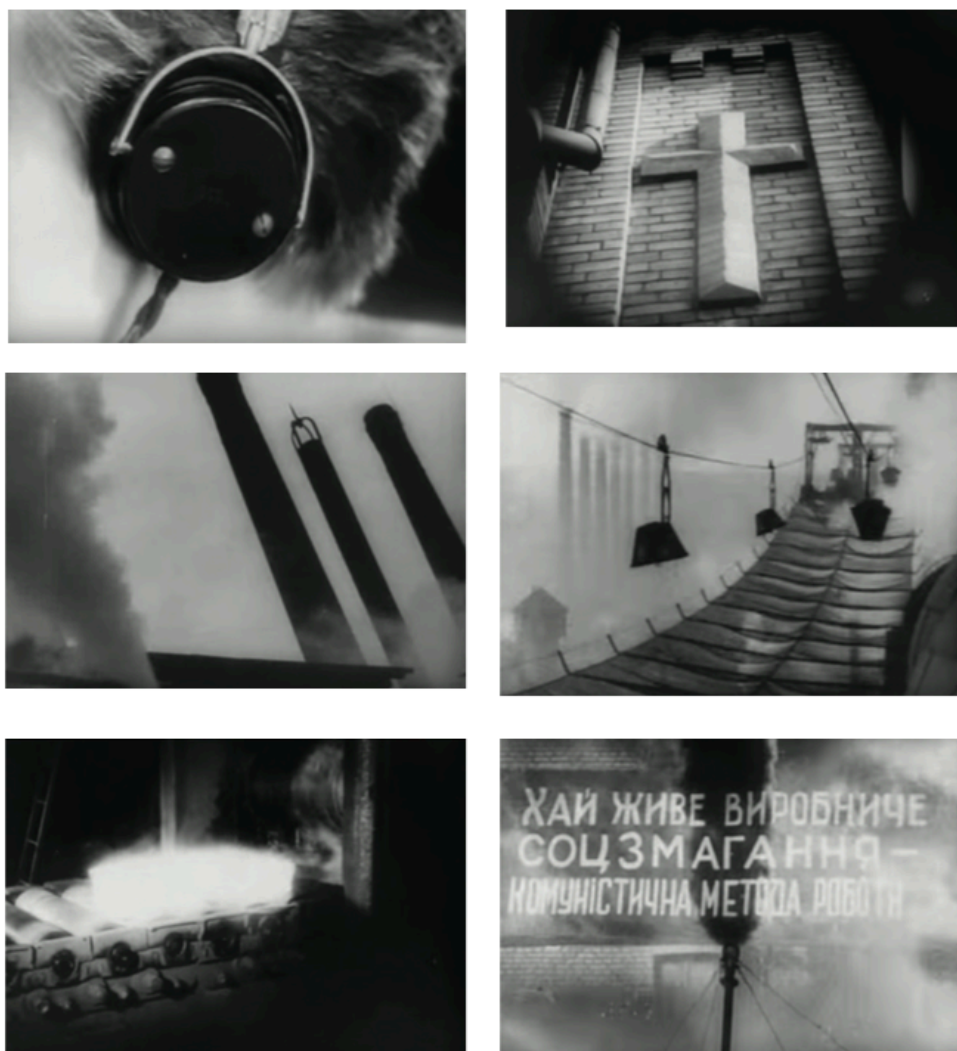
Virtually unknown but equally significant is Delia Derbyshire, who started working for the BBC as a trainee assistant studio manager in 1960 and later oversaw their “avant-garde” Radiophonic Workshop (BBC, 2010). Derbyshire had a degree in mathematics and music and an interest in the theory and perception of sound. She created music and sound design for almost 200 radio and television programs, but her most well-known work is the original *Doctor Who* (1963) theme. Ron Grainer composed the basic melody and Derbyshire provided the iconic sounds and form of the theme. Most of her early work remained anonymous or credited as “special sound” by the BBC. *Four Inventions for Radio* (1964–65) is described as the best illustration of Derbyshire’s particular style of “soundscaping”. She also worked across film, theater, and electronic music events, creating music for a film by Yoko Ono and



sharing a bill with Jimi Hendrix. Among those who credit her as an influence are Orbital, Portishead, Aphex Twin, and the Chemical Brothers.

Soviet filmmaker Dziga Vertov also experimented with similar concepts to that of musique concrète, most notably in his first sound film, *Enthusiasm: Symphony of the Donbass* (1931), which was also the first Ukrainian sound film. The film is shot in eastern Ukraine and dedicated to Stalin's first Five-Year Plan (1928–32), as a celebration of industrialization and collectivization. Vertov's films heavily influenced the Cinéma Vérité (truthful cinema) style of documentary filmmaking, and *Enthusiasm* is considered an innovation in film, primarily because of the soundtrack and its use of industrial sounds such as the clash of hammers, train whistles, bells, and the songs of workers. Vertov had welcomed the coming of sound and perceived it as a “radio-ear” to accompany the “cinema-eye” (Croce, 2016, p. 58).

I was returning from the railroad station. In my ears, there remained chugs and bursts of steam from a departing train . . . somebody cries out . . . laughter, a whistle, voices, the station bell, the clanking locomotive . . . whispers, shouts, farewells . . . And walking away I thought there is a need to find a machine not only to describe but to register, to photograph these sounds. Otherwise, one cannot organize or assemble them. They fly like time. (Vertov in Feldman, 2014, p.23)



*Fig 2:18 Enthusiasm: Symphony of the Donbass (1931, dir. Dziga Vertov), Ukrainfilm*

Sound design and the creation of sound design effects or elements are a form of musique concrète; the concepts, ideas, and processes behind both practices are much the same. The methods employed by contemporary sound designers are subjected to very similar sound-sculpting techniques as those developed by these earlier artists, and many film sound designers attribute hearing earlier works as inspiring their

interest in sound design. One of the reasons for the confusion that surrounds sound design is that the term is often used in reference to other art forms.

Sound design is an element, and often the main element, in film sound design, sound art, sound sculptures, and sound installations. A *soundscape* is generally defined as a combination of sounds that either forms or arises from an environment, and the study of soundscapes is called acoustic ecology. Canadian composer and sound ecologist R. Murray Schafer coined the term in reference to environments, abstract constructions, and sound montages. *Sound art* considers sound, listening, and hearing as its predominant focus and engages with the subjects of acoustics, found or environmental sound, psychoacoustics, electronics, music, sculpture, screen media, and technology. *Sound sculpture* generally describes an art object that produces sound, or the reverse; sound is manipulated in such a way as to create a sculptural form or mass. *Sound installations* are usually site-specific installations that include a sound component that makes a dialogue with the surrounding space. All forms of sound art involve sound design and associated processes, but soundscapes, sound art, and installations are generally less narrative or non-narrative and not as visually oriented as sound design for film and animation, which is primarily concerned with story and image.

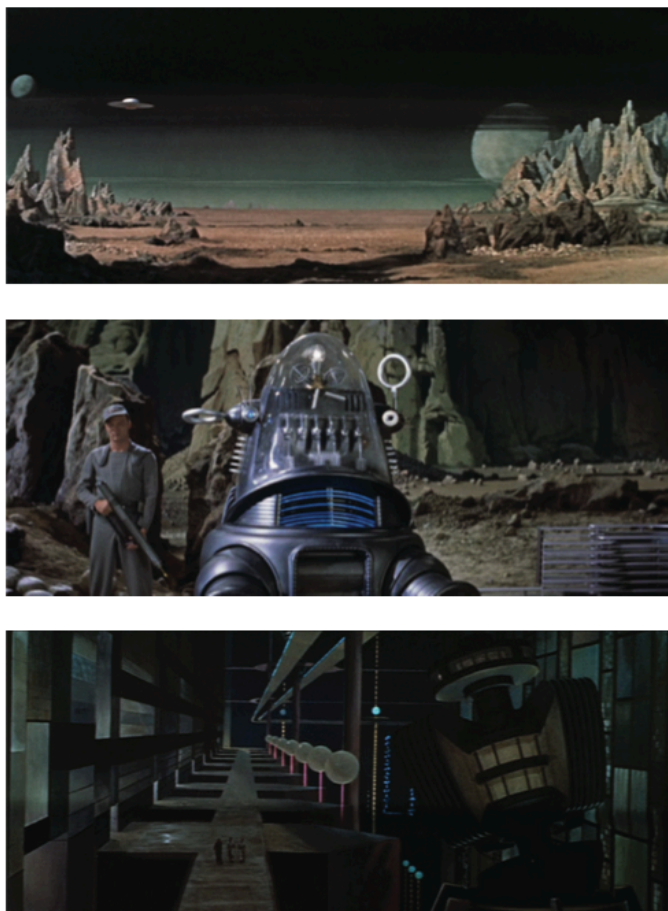
## FICTIONS OF SCIENCE

### **Synthesis, new Waves, and Ambiguity**

Science fiction has had a huge impact on sound design. Georges Méliès's *Le Voyage dans la Lune* (1902) is considered the first science fiction film and pioneered the use of special effects in film. By the 1950s, science fiction had become a popular genre, and sound artists were breaking new ground in sound design through creating soundtracks for films such as *Forbidden Planet* (Wilcox, 1956). Modeled on *The Tempest*, reviewers reacted enthusiastically to the film's mix of Shakespeare and science fiction. It was nominated for a Special Effects Oscar, and despite losing out to *The Ten Commandments* (DeMille, 1956), the visual effects work was considered

very sophisticated for the time. *Forbidden Planet* was also the first film to be produced with an entirely electronic “score.”

The film is set in the late twenty-second century. A United Planet cruiser is sent on a special mission to look for survivors from an expedition on distant planet Altair-IV. On the planet, Professor Morbius builds robots and raises his daughter, Altaira, who was born on Altair-IV. When the cruiser from Earth arrives, Morbius tries to warn them off, but they ignore his warning and land. An invisible force kills some of the crew; Morbius believes it is the same unknown entity that killed nearly everyone from the previous expedition. While living on Altair-IV, Morbius had been studying the Krell, a highly-advanced race that mysteriously died out 200,000 years previously. In a Krell laboratory, Morbius shows off a device capable of measuring and enhancing intellectual capacity. It was the device that had given him the ability to build Robby the Robot. Altaira falls in love with the commander from the ship, who demands that the Krells’ knowledge be turned over. Morbius refuses and chaos unfolds. It’s later revealed that the “monster” is actually the professor’s repressed subconscious. Morbius eventually accepts the truth—that the Id monster is an extension of his own mind, unleashed by his experiments with Krell technology, and is the same entity that killed the original expedition.



*Fig 2:19 Forbidden Planet* (1956, dir. Fred M. Wilcox), Metro-Goldwyn-Mayer (MGM)

### **Film and Electronica**

Husband and wife team Louis and Bebe Barron created *Forbidden Planet*'s sound design and electronic score, which was credited on the film as "electronic tonalities." Bebe and Louis Barron were both trained musicians with an interest in electronic music. They knew of Pierre Henry's and Pierre Schaeffer's work as well as that of Karlheinz Stockhausen and the "Elektronische Musik" group in Koln, which produced the first music created solely from electronic generators in the early 1950s (Cross, 1968). They also worked with John Cage and other experimental composers, collaborating on a number of sound projects for film, dance, and theater. In 1951, John

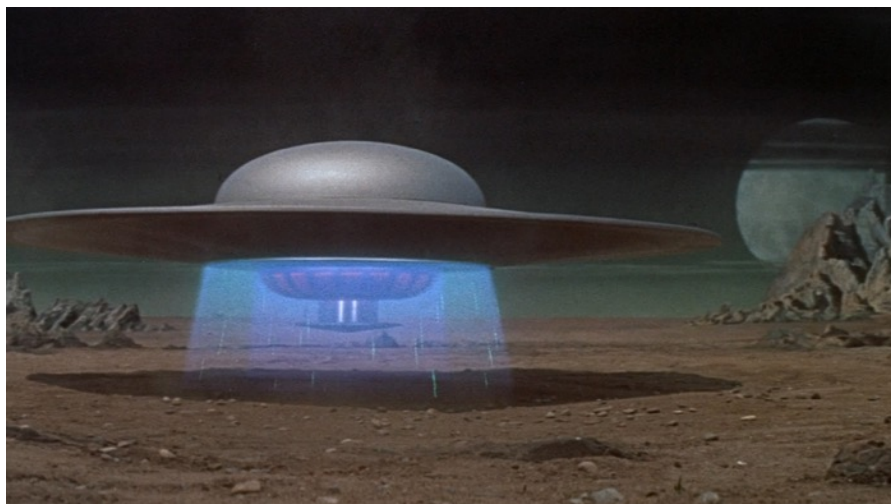
Cage organized a group of musicians and engineers to produce music directly on magnetic tape with technical assistance from Louis and Bebe Barron. Prior to *Forbidden Planet*, they worked on experimental films and theater but wanted to take on larger and more financially rewarding productions. In his 1979 autobiography, MGM head Dore Schary credits Louis and Bebe's score as a primary factor in *Forbidden Planet*'s cult status. Originally the Barron's music was to be incidental to a more conventional orchestral score, but they ended up creating the whole film soundtrack, including most of the sound effects. Since the Barron's did not belong to the Musicians Union, they could not be considered for an Academy Award, and there was also some debate as to whether their work should even be called "music," as the soundtrack was produced directly to tape and there was no notated score. The Barrons later released their soundtrack in 1976 as an LP album for the film's twentieth anniversary. While their work on *Forbidden Planet* is usually defined as score, it is actually a combination of sound effects, sound design effects, and score. The soundtrack bore no resemblance to the traditional approach to film music, which was unique at that time.



Fig 2:20 Bebe and Louis Barron, Walter Daran, Contributor, Getty Images

While the theremin, an electronic instrument, had been used earlier on the soundtrack of Alfred Hitchcock's *Spellbound* (1945), the Barron's electronic sound designs preceded the invention of the Moog synthesizer by eight years. The Barron's got some of their ideas from the book *Cybernetics: Or, Control and Communication in the Animal and the Machine* (1948), written by the mathematician and electrical engineer Norbert Wiener. Wiener is considered the founding father of cybernetics, which is the science and study of control mechanisms in human and machine systems. Louis followed principles described in the text and designed various oscillator and ring modulator circuits, which were used to generate sound. Striving to create an organic quality despite using electronic circuits, the Barrons likened their work to cybernetic biological processes. They equated their circuit designs with the neural circuitry of an organism, and the resulting sounds were intended to produce an emotional response or effect.

We used many circuits from Norbert Wiener's book *Cybernetics: Or Control and Communication in the Animal and the Machine*. We recorded and amplified the electronic activity and endlessly processed it, since they were all mathematical equations they seemed to have a kind of order and organic rightness. Entropy and information theory contributed ideas on probability and randomness, which we had to use since that was the only thing our circuits were capable of. We thought of our circuits as characters in a script, and used the unfolding of pitches as they came out of the circuits. We didn't control the pitches at all. The emotions which seemed to come out of the circuits such as romance, monsters, space travel were almost always in [sic] upper most in importance. Each circuit we built had life spans of their own . . . [and] once they died we could never revive them. (Bebe Barron in Chasalow, 1997)



*Fig 2:21 United Planets Cruiser from Forbidden Planet (1956, dir. Fred M. Wilcox), Metro-Goldwyn-Mayer (MGM)*

The Barron's devised a list of "characters" and approached the soundtrack like a director would direct actors. Circuits were built, activated, and then personified. Bebe undertook most of the selecting and production, while Louis did most of the circuitry design. He constructed various electronic circuits to generate the bleeps, whirs, whines, throbs, and hums for spaceships, robots, and technology in the film. Their process involved isolating suitable fragments or samples they felt had the potential for further work. Together they mixed and manipulated sound by adding effects such as reverberation and delay and reversing or changing the pitch of sounds. Sound design and textural effects were created to express the eeriness of space and the strangeness of Altair-IV; many of these sounds were generated using a ring modulator. A ring modulator multiplies two signals together to create two brand-new frequencies that are the sum and difference of the input frequencies. Ring modulation is often used to simulate the sounds of tuned percussion instruments that produce inharmonic frequency content, such as bells and chimes, which tend to sound metallic or robotic. An oscillator is an electronic circuit that produces a periodic, oscillating electronic signal, often a sine or a square wave. Audio oscillators produce frequencies in the



range around 16 Hz to 20 kHz, and a low-frequency oscillator (LFO) generates a frequency below 20 Hz. Oscillators form the basis of sound synthesis.

The roaring Id/beast came out of the circuit sounding not remotely like a beast, it was very high pitched, tinkling, with very complicated harmonic sounds, I would go through all the tapes and select things that had the most potential for further processing. When I heard all that high-pitched activity, such complicated sounds, I said to Louis, “We’ve got to slow this way down.” We probably lowered the frequencies 60 or 70 times (playing it back at half speed while re-recording at 15 i.p.s.). And each time we slowed it down more of the sound would emerge to the foreground while other parts would disappear. But finally, we got to what we thought was the optimum speed—the rhythm was all there. That’s the way the monster sound came about.

The preview showing was one of our great experiences because they played the music directly off the magnetic tapes. They had synced up the projector and tape and they gave it so much volume it was embarrassing. It was so effective—they played it stereophonically, which they never did in those days. Then there was the landing of the space ship. That was one of the best cues in the picture—and the audience broke into spontaneous applause. (Bebe in Brockman, 1992, para. 22–33)



*Fig 2:22 Monster of Id from Forbidden Planet (1956, dir. Fred M. Wilcox), Metro-Goldwyn-Mayer (MGM)*

### **New Waves**

The 1950s also generated the New Wave (*La Nouvelle Vague*), which refers to a group of French filmmakers who transformed French cinema during the 1950s and 1960s. They also had a pronounced impact on filmmakers throughout the world during and after that period. Through experimental techniques, they fashioned a new cinematic style. Cinema was important in postwar France, and most of the New Wave directors were influenced by everything from realist Italian directors to American noir and B movies. The most common descriptions of early New Wave films is that they are “low budget” and made “outside” the conventional system. New Wave filmmakers rejected the traditional Hollywood tendency to base narrative styles and structures on earlier media, namely books and theater. Previously there were two primary camps of filmmakers: spectacle and special effects, or fact and observation. Many saw popular movies of the era as out of touch with the daily lives of postwar youth, and mainstream audiences were starting to decline due to the impact of television and emergent art cinema. New Wave films often engaged with the social and political upheavals of the time.

The scripts or lack thereof were considered revolutionary, and the modest budgets forced filmmakers to become inventive. Technical developments in cameras, film stock, and sound recording had made it easier for people to experiment with

filmmaking. As a result, New Wave films became known for certain stylistic innovations such as unusual camera angles, handheld shots, jump cuts, rapid editing, the use of natural lighting, improvised dialogue, direct sound recording (as opposed to the dubbing), using nonprofessional actors, and long takes. Concurrently, there were echoes of the French New Wave across the globe; the Free Cinema Movement in Britain, *Cinema Novo* in Brazil, and the New German Cinema of the 1960s. They all had their own particular style, but universally they were a reaction against what had come before. While arguably not the only, or even the first, wave, when taking into consideration German expressionism, Italian neorealism, and Soviet formalism, the French New Wave was later acknowledged as a major inspiration for Hollywood's generation of new directors such as George Lucas, Francis Ford Coppola, and Martin Scorsese.

The science fiction genre also became an increasingly popular genre for exploring alternatives in film form, and French New Wave filmmakers recognized the genre as a vehicle for stylistic experimentation. One of the first experimental French short science fiction films was *La Jetée* (*The Jetty*), released in 1962, and the inspiration for the feature film *12 Monkeys* (Gilliam, 1995). Written and directed by Swiss filmmaker Chris Marker, *La Jetée* is set in the aftermath of World War III. Survivors shelter underground while a group of scientists experiment with time travel. The aim is to perfect travel into the future by perfecting travel to the past, and by traveling into the future, the scientists hope to find a way to change the present. A survivor obsessed with memories of a mysterious woman and a man's death on the pier at Orly Airport is chosen to participate in the experiment. The film's title refers to the large "jetty" or pier-like structure at Orly Airport outside Paris, where the time traveler as a boy sees the man killed and the woman who witnesses the event. The story is told through the use of black and white stills, voice-over narration, sound effects, atmos(phere), and music. It contains one brief shot of filmed motion and is described by the credits as a "photo-roman," or photo-graph-fiction. The still images are connected by cuts, fades,

and dissolves. The voice-over tells the story, while the airport atmosphere, which includes public address (PA) announcements and sound effects, adds a sense of realness to *La Jetée*. The sound of birds is used in a similar fashion, getting louder as if to provoke a sense of doom and challenge perceptions of reality. The presence of the conspiring scientists is conveyed through whispering, while the psychological effects of the experiments are revealed through the sound and rhythms of a heartbeat.



*Fig 2:23 La Jetée (1962, dir. Chris Marker), Argos Films, Radio-Télévision Française (RTF)*

### **Sonic-psychedelia**

*La Planète Sauvage (Fantastic Planet)*, an abstract science fiction feature film, won the Special Jury Prize at Cannes in 1973 and is considered a landmark in European animation. The film is a cutout stop-motion animated film directed by René Laloux, with production design by Roland Topor, music by composer Alain Goraguer, and sound design by Jean Guérin. It was five years in the making at Prague's Jiri Trnka Studios and is regarded by some as an allegorical statement on the Soviet occupation

of Czechoslovakia. Based on Stefan Wul's novel *Oms en série* (*Oms by the Dozen*), the film is set on an alien planet called Ygam, where humans (Oms) are enslaved by a larger and more superior alien race (Draags). The Draags treat humans like animals; some are domesticated and kept as pets, while others live in the wilderness and are periodically slaughtered by the Draags as a form of population control. The Draags maintain a technologically and spiritually advanced society where education is received through headphones that transmit knowledge straight to the mind.

The film opens with an Om mother being literally teased to death by three Draag children. A Draag leader discovers the woman's orphaned infant and he allows his daughter Tiva to keep him as a pet. Tiva names him Terr and controls him through a collar that can pull him in any direction she wishes. She brings him to her teaching sessions, and a defect in his collar allows him to receive the same knowledge she is receiving. Terr becomes a young man and eventually escapes with Tiva's headphones. He meets a female Om who cuts off his collar and introduces him to her tribe. After a duel, he is permitted to show them how to use the headphones to acquire Draag knowledge. This enables them to read Draag writing, and they discover their area is about to be purged. Some escape and join forces with another tribe. They take over an abandoned Draag rocket depot and with the knowledge acquired from the headphones learn how to adapt Draag technology. When a large-scale Draag purge hits the depot, a group, led by Terr, flees in rockets to the Fantastic Planet. They discover statues that Draags travel to during meditation and through strange rituals with other beings maintain their species. The Oms destroy some of the statues, which threatens the Draags' existence. The purges are halted and, facing a crisis, the Draags opt for peaceful coexistence.

The film has an abstract-surrealistic-psychedelic-hallucinatory visual sensibility that mixes seventies avant-garde rock with sound design reminiscent of Bebe and Louis Barron's earlier work on *Forbidden Planet*. The Barron's had to design and build a

number of circuits to produce particular sounds, and each could only perform a limited range of functions. Early electronic devices like the theremin were also relatively limited, and the first sound synthesizers were largely impractical. The RCA Mark II sound synthesizer, designed by Herbert Belar and Harry Olson at RCA was the size of a room, and the first programmable electronic synthesizer. By the 1970s, sound designers were using a modular voltage-controlled analog synthesizer pioneered by Dr. Robert Arthur Moog. Moog became interested in the design and construction of complex electronic music systems in the mid-1960s while completing a PhD in engineering physics. The invention of the transistor led to the creation of the Moog synthesizer, which was smaller, cheaper, and more reliable than earlier systems. The introduction of electronic instruments opened the door to creating sounds that sit outside what is typically perceived as a sound effect, further clouding the line between sound effects and music, which is where sound design is often situated.



*Fig 2:24 La Planète Sauvage (1973, dir. René Laloux), Argos Films, Les Films Armorial, Institut National de l'Audiovisuel (INA)*

### **The Ambiguous Twilight Zone**

Walter Murch is a well-known sound designer, re-recording mixer, and picture editor. He studied liberal arts before attending film school at the University of Southern California (USC), and he launched his career through working on the American Zoetrope's first film, *The Rain People* (Coppola, 1969). A core objective for American Zoetrope was to circumvent the departmentalism of the studio system, and as film technology had become more affordable, it made sense for the sound designer to take responsibility for the soundtrack. Murch has since worked on films such as *The Conversation* (1974), *Julia* (1977), *Apocalypse Now* (1979), *The Unbearable Lightness of Being* (1988), *Ghost* (1990), *The Godfather: Part III* (1990), *Romeo Is Bleeding* (1993), *The English Patient* (1996), *The Talented Mr. Ripley* (1999), *Cold Mountain* (2003), *Jarhead* (2005), and *The Wolfman* (2010). He has received numerous awards for both sound and picture work, directed the feature film *Return to Oz* (1985), and in 2001 wrote *In the Blink of an Eye*, a well-regarded book on film editing. Murch is also widely acknowledged for introducing the term “sound design” in the 1970s. On previous films, his work was credited as “sound montage.” The term “sound montage” was adopted to avoid altercations with the union—he wasn't a member, so he couldn't be credited as a sound editor—and to more accurately reflect the increasingly conceptual nature of soundtrack design. *THX-1138* (1971), directed by George Lucas, was the first “mainstream” feature film to use the credit of sound designer.

While also attending USC, George Lucas directed the short film *Electronic Labyrinth: THX 1138 4EB* (1967). The screening synopsis described the film as “a nightmare impression of a world in which a man is trying to escape a computerized world which constantly tracks his movements” (USC, 1967). The film is set underground, in a dystopian future, which the lead character attempts to escape. The story is primarily told through POV from video security cameras, which supports the central theme of a totalitarian order reliant on surveillance technology to control the population. The film is abstract and the soundtrack mostly non-sync, consisting of music, phrases, and word

fragments treated as radio and intercom communications, electronic hums, beeps, and alarm sound effects. With support from Francis Ford Coppola, the short was reworked as *THX 1138*. Lucas wrote the original story and in collaboration with Walter Murch rewrote the screenplay.

Lucas describes *THX 1138* as a parable or metaphor for how people were living in the 1960s, and Murch describes it as an investigation into the ramifications of a self-contained world, disconnected from the organic world, with an unbridled consumer culture. The film depicts an underground society living in a clinical environment policed by androids. Key themes are conformity, consumerism, and surveillance. The population prays and confesses to their god OMM 0910, who responds through prerecorded messages, but there is no god or leader; the society is controlled by drugs and made bureaucratic by the people who participate in it. Inhabitants are sedated and dressed in white, with shaved heads. Consumerism is encouraged, while any form of emotion is a punishable offence. The story centers on THX 1138 and his female roommate, LUH 3417. THX 1138 handles radioactive materials in a factory, and LUH 3417 is a disenchanted surveillance worker. After she stops taking the emotion-suppressing medication, she gives placebos to THX 1138. He also becomes self-aware and they form a relationship. They plan to escape to the “superstructure” but are caught and detained. THX 1138 is imprisoned in a wall-less white void where he is beaten, but later, with the help of a hologram, he escapes. After discovering that the now-pregnant LUH 3417 has been killed, he makes his way to the surface.





*Fig 2:25 The factory in THX 1138 (1971, dir. George Lucas), American Zoetrope, Warner Bros.*

Lucas wanted the film to feel like an artifact from the future, as opposed to a film about the future. The aim was to tell the story subliminally, by creating an aural-visual experience that was more atmospheric, more stylized, and grittier than a traditional film narrative. Lucas also drew inspiration from Theatre of the Absurd, a theatrical movement that developed in the late 1950s around the philosophy of existentialism: Humans define their own meaning in life and try to make rational decisions despite existing in an irrational universe. As both Lucas and Murch have pointed out, *THX 1138* is not always coherent. Seeing a lizard doesn't make sense in the setting presented; it's thematic, a living thing trapped in a synthetic environment, an analogy or metaphor for the lead characters. The same concept is applied to the sound design, which functions beyond cause and effect, seeing and hearing, and often counters what's seen. At times, sound is addressing a different element of the story, and sometimes themes are being addressed simultaneously. Images and sound are intentionally disconnected, which creates tension and a feeling of unease.

Murch identifies contemporary films as fitting into two categories, either dialogue-driven films, where the visuals and the sound play a secondary and supporting role,

or action-driven films, where the images and accompanying sounds are often powerful and overwhelming, and the dialogue is reduced to a support role. Lucas defines the approach to *THX 1138* as “pure cinema,” based on visual and sound design, as opposed to overreliance on action, dialogue, or music. While soundtracks are typically broken down and categorized as dialogue, music, and effects, conceptually the lines often overlap—they blur. Between each classification is what Murch describes as an “ambiguous twilight zone.”

Sound effects are like people who can travel around the world without any passports. Sound effects have a way of sneaking under the radar so that you can be being affected by them in musical ways, emotional ways but because they seem to be being produced by the visuals, by the world that you’re looking at you tend to accept them at face value and not as something the filmmakers are doing to create an emotional effect with you, whereas that’s not the case with music. (Murch in Leva, 2004)

Murch also termed his approach to designing the sound for *THX 1138* as “cubistic sound.” Cubism is an early twentieth-century avant-garde art movement that inspired related movements in music, literature, and architecture. Cubism is considered the most influential art movement of the twentieth century. In artwork, objects are analyzed, broken up, and reassembled in an abstracted form, instead of from a single viewpoint, to represent the subject in a greater context. In *THX 1138*, each scene was treated as a cube of sound, and each cube had a slightly different sound. The prison “room” is a white void with no discernable walls and therefore not actually a room. So the “room tone” needed to be less room and more tone, which was derived from a recording of the Palace of Fine Arts in San Francisco, a curved room that houses science experiments. Like all rooms, it has a tone, but not many rooms are curved and have an unidentifiable “mechanical something” as part of the tone. Most of the

material used in the film was from original recordings, except for two stock sound effects, thunder and a punch. It was also decided from the beginning that unlike in many science fiction films at the time, there would be no or minimal electronically generated sounds. While the “cattle prod” the police use to torment THX 1138 is electronic-sounding, or has an electric tinge, it was created from an organic source. Murch recorded different hits on a metal lamp shade, edited out the attack of the hits, and combined one hit played forward and one played backward.



*Fig 2:26 The prison in THX 1138 (1971, dir. George Lucas), American Zoetrope, Warner Bros.*

In addition to synchronized dialogue, dialogue effects in the form of radio and intercom communications (or “chatter”) are used throughout the film. In the public spaces, like the shopping mall, voice is used to communicate the nature of the society— in the case of the shopping mall, consumerism. The public-address broadcasts are also treated to reflect the physical environments. At the time the film was produced, audio processing equipment was limited, so Murch recorded dialogue in real spaces to get authentic-sounding reverbs and echo, a technique he called “worldizing.” Murch and Lucas also recorded dialogue material through the use of ham radios, one broadcasting and one receiving, which altered the timbre or tone of

the dialogue. The police are all the same, one pervasive voice, which sounds totalitarian and has a logic: The police are robots, and why would you bother to program voice variations? Murch also experimented with temporary music tracks from mainly classical records. He re-recorded tracks backwards, slowed them down, and layered them, effectively treating preexisting music as raw material for the creation of temporary soundscapes. Many of the results were later adapted by composer Lalo Schiffrin and rerecorded as a musical score.



*Fig 2:27 Surveillance center in THX 1138 (1971, dir. George Lucas), American Zoetrope, Warner Bros.*

### **Architects of Sound**

By the late 1970s, independent filmmakers such as Francis Ford Coppola, Martin Scorsese, and George Lucas had embraced the creative potential of sound. Francis Ford Coppola first credited sound design on *Apocalypse Now* (1979) in recognition of Walter Murch's overall contribution and supervision of sound for the film. *Apocalypse Now* (Coppola, 1979) was central to the progression of film sound design and the development of the surround soundtrack. The film is set during the Vietnam War. Army captain and special operations veteran Benjamin L. Willard (Martin Sheen) is tasked with terminating special forces colonel Walter E. Kurtz (Marlon Brando), who

has adopted a demigod-type persona and gone insane. Willard's objective is to travel down the Nyung River by boat and assassinate the defective Kurtz. As Willard and the crew embark on their journey, they confront the same horrors and hypocrisy that pushed Kurtz over the edge. When they arrive at Kurtz's outpost, Willard is brought before Kurtz and lectured on his theories of war, humanity, and civilization. Regardless, Willard attacks and kills Kurtz with a machete. The film depicts the insanity of war, Willard's journey, and his growing understanding of how Kurtz, one of the army's best soldiers, was driven to madness and despair.

In discussions between George Lucas (the original director), Walter Murch, and scriptwriter John Milius, it was identified that one of the elements that made the Vietnam War different and unique was the prevalence of helicopters. In the film, the war is presented from Willard's point of view, which is established in the opening sequence, forming a connection between the sound of helicopters (war) and Willard's state of mind. A synthesized sound design effect is heard "swooping" on a wide shot of the jungle. As it passes across the frame, *The Doors'* "The End" begins with a fragmentary mix of fog, flames, and helicopters, images of Willard and a ceiling fan. The helicopter sound becomes more realistic as Willard's "reality" comes into focus: He's in a hotel room in Saigon. Realistic sounds were deconstructed on synthesizers to mimic the real sounds; as Murch explained, "The helicopter provides you with the sound equivalent of shining a white light through a prism—you get the hidden colors of the rainbow" (Murch in Isaza, 2009). In the same way sound effects are created, the helicopters were broken down to their individual parts: rotor, turbine, clanks, thuds, and blades. Combined they sound realistic; individually, and treated, as with the blade, a dreamlike quality surfaces.

At the time, sound libraries had no stereo recordings of weapons, and the location sound material was problematic, so the film had to be thoroughly sound designed. It also needed to be authentic to the location, period, craft, and weapons used during the

Vietnam War. The original plan was to make the film soundtrack quadraphonic and release it in 70mm Dolby Stereo. Quadraphonic sound is 4.0 surround sound and uses four channels, in which speakers are positioned at the four corners of the listening space. It was the earliest surround sound consumer product, and thousands of quadraphonic music recordings were made during the 1970s. *Superman* (Donner, 1978) was the first film to use 70mm "Split Surround" as a beta-test project. The surround was split into left and right. *Apocalypse Now* (Coppola, 1979) was the first film to officially make use of the new format. The format established while working on *Apocalypse Now* comprised six tracks: three channels in the front, two channels in the rear, and a subwoofer channel. Coppola wanted the explosions to be felt in addition to being heard, and the circular nature and motion of helicopters suited immersive techniques and the surround format; they fly, move around, and hover. Released to wide acclaim, *Apocalypse Now* is frequently held up as one of the most notable examples of creative sound design in filmmaking and integral to the development of 5.1 surround sound. Dolby Atmos takes that another step by supporting up to 128 discrete audio tracks and sixty-four speaker feeds, which allows film-makers to create even more highly immersive and cinematic story experiences.



*Fig 2:28 Apocalypse Now (1979, dir. Francis Ford Coppola), Zoetrope Studios, Zoetrope Studios*

*Star Wars: Episode IV—A New Hope* (Lucas, 1977) also marked a definitive turning point in the understanding of and interest in film sound. Lucas founded Industrial Light & Magic (ILM) specifically to create the visual effects for *Star Wars: Episode IV* and Sprocket Systems, which later became Skywalker Sound, for creating the soundtrack. Prior to the production of *Star Wars: Episode IV*, Ben Burtt was a student at USC. Producer Gary Kurtz contacted USC looking for someone to record sounds that might be useful, and Burtt was recommended (Burtt in Lauten, 2002). Burtt's work on *Star Wars* incorporated the roles of sound recordist, sound editor/designer,

and sound mixer. He spent a year recording and editing various sounds and created hundreds of different sound effects. Droids, crafts, creatures, and weapons all required sound designing. In discussions with Lucas, it was decided that sound should be organic as opposed to electronic or artificial sounding. Science fiction films still had a tendency to use electronic-sounding effects, and Lucas wanted to create a “used universe,” in a similar vein to *THX 1138*.

*Star Wars: Episode IV* is set in “a galaxy far, far away”, where the Galactic Empire is nearing completion of the Death Star space station and planning to crush the Rebel Alliance. Luke Skywalker, a farm boy, and his step-uncle and aunt purchase astromech droid R2-D2 and protocol droid counterpart C-3PO. While cleaning R2-D2, Luke triggers a message from Princess Leia, a member of the rebellion captured by Darth Vader. In the message, Leia asks for assistance from Jedi knight Obi-Wan Kenobi. Luke and the droids track down Obi-Wan Kenobi and hire smuggler Han Solo and his Wookie copilot Chewbacca to take them to Leia’s home world, Alderaan. After discovering the Death Star has destroyed Alderaan, they board the space station to rescue Leia and escape with plans that help them destroy the Death Star.

The aural palette was drawn from the real world, familiar but not necessarily identifiable sounds. The blasters were devised from striking a steel cable on a radio tower and the Tie Fighter was a manipulated elephant bellow. The lightsaber, an iconic sound effect, was also the first sound design effects Burt created. While attending USC, he worked as a projectionist and noticed a motor in the booth that hummed when it was idling. Burt described the hum as having a musical sound and a hypnotic tone. A few weeks later, he had an incident with a broken microphone cable, and the microphone picked up a hum from a nearby television picture tube. Burt described that sound as having a scintillating and angry buzz. The two sounds combined became the lightsaber. The Imperial Walkers introduced in *The Empire Strikes Back* (1980) were described in the script as big, heavy, lumbering mechanical beasts. ILM created



models ranging from six to fifty centimeters in height, which were filmed using stop-motion animation against matte paintings. Burt needed to design sounds that would give the miniature Walkers mass and weight. Motors and metal clunks were created from recordings Randy Thom made of a metal stamping/ shearing machine, and the sound of the Walkers' "joints" were from recordings of a large Dumpster lid (Rinzler, 2010). Using purely organic sounds helped create the illusion of reality—the physicality and weight of the lumbering mechanical beasts.

Darth Vader's breathing is also one of the most remarked on sounds from the films. In the script, Darth Vader is described as a strange and dark being that breathed abnormally and was sustained by some kind of life-support suit. Burt went to a local dive shop and recorded different scuba masks and regulators, which he slowed down to become the breathing of Darth Vader. He originally designed a multitude of robotic sounds for the suit but found they overwhelmed the mix. Mix problems aside, not "knowing" can be more engaging than knowing. When Darth Vader first appeared on-screen, he was a very mysterious and imposing figure. Chewbacca's voice was developed when *Star Wars* was still at script stage. Chewbacca (a 200-year-old Wookie) becomes Han Solo's companion after Solo is dismissed from the Imperial Navy for refusing to kill the Wookie. Chewbacca repays the debt by protecting Solo and becomes his copilot on the Millennium Falcon. His character was defined as gentle, hairy, and non-English-speaking. As he was required to act and communicate with other actors, he needed a language that was not recognizable as human or English but was still intelligent and believable. His "dialogue" also needed to look credible and lip-sync with Chewbacca's limited mouth movements. Lucas suggested bear growls as a starting point, and Burt created his speech principally from recordings of bears, but also dogs, lions, tigers, badgers, and walruses. He edited together fragments of the recordings to create a sense of speech, with emotional associations or expressive tones such as affection, pain, and anger. Designing R2-D2's beeps and whistles proved to be a more difficult task. R2-D2 is a droid, therefore a machine, but he also needed

to act, have a personality and be able to communicate. Unlike Chewbacca, he had no human or animal features, no face, eyes, or ears. Burt's initial designs were deemed too machinelike and lacking in human quality, so he experimented with his own voice by mimicking infant type non-word sounds. What resulted was a combination of his voice and electronic sounds he generated with a synthesizer. By combining synthetic with organic material, he gave R2-D2 emotion, through inflection and intonation of voice.

By the early 1970s, Dolby-noise reduction equipment dominated the music recording industry and Dolby turned its attention to film sound. Senior vice president at Dolby Laboratories Ioan Allen described soundtracks in the 1960s as having poor quality and being little more than "audible subtitles." In 1974, Dolby released the 70mm split stereo format, a precursor to 5.1 surround sound. The technology's commercial breakthrough was *Star Wars*. Lucas wanted something that had never been heard before, and the initial plan was to use "Sensurround," which involved running a soundtrack with low-frequency content through a series of speakers. It was developed to enhance the audio experience during film screenings, specifically for the film *Earthquake* (Robson, 1974). Instead, Stephen Katz from Dolby suggested a different approach, reconfiguring the original six-track 70mm format to a different standard; three screen channels, one surround and a "Baby Boom" channel containing only low frequency content, using separate channels and level adjustments (Holman, 2008). The film was released as a 70mm film with stereo sound. Projecting 70mm meant the original 65mm film (or 35mm blow-up) was printed on 70mm film with the additional 5mm for four magnetic strips holding six tracks of sound. The original six discrete uncompressed channels were reconfigured into a left, center, and right screen channel plus a surround channel. The soundtrack became a big part of the *Star Wars* "spectacle" that continues today.

### **Sleeper – Mixed Media Short (online)**

Sleeper is a mixed media short film that blurs the lines between being awake and asleep, the real and surreal. *After falling asleep on a train, a young woman is lured by a monkey into a nightmare-dreamscape.*



*Fig 2:29 Sleeper (2008, dir. Craig Gladding)*

The film is an example of a completely sound design driven film; even the dialogue and music are effectively sound effects. The overall sound design mirrors the visual aesthetics, rhythm and the way dreams and nightmares tend to feel disconnected, fractured and “not quite right”. Some of the sound effects are real and organic, some are synthetic; generated from old analog synthesizers and newer virtual instruments, and some are a combination of both real and generated. Various elements were layered to create a sense of reality, hyper-reality and surrealism, while the mix purposefully borders “nonsensical”; certain effects are louder and more present than they should be, or would be, in a different film.

The film starts with the introduction of the train, the “Sleeper” as a monkey in a tree watches. Inside, a young woman appears to be asleep, we hear the train rattle, curtains

rustling, coinciding with trees passing through the window, which “swoosh” by, reversed, a subtle indication of “something not quite right”. The woman wakes and looks out the window, as if unsure of where she is. She becomes drowsy, and we notice a paper butterfly, but it’s alive, it moves and sounds. The scene is “interrupted” by the monkey stealing the butterfly. This intrusion angers the woman who attempts to grab the monkey, but misses, and forms a fist, accompanied with the sound of “knuckles cracking”. The scene then collapses, the train carriage “literally” collapses, with a crash, revealing a strange (sounding/looking) jungle. The woman searches for the monkey. It swooshes past on a rope, chattering, as if mocking her. He settles in a tree, losing the butterfly, which lands on one of feet, as a snake appears forming a “question mark”. The butterfly flies away, taking the audience back into the train where the woman is sleeping. It is at the point the film reveals it is a dream. The butterfly flies through the train windows and back into the jungle, as the woman attempts to catch it. She fails and continues to follow the butterfly, and the scenes unfolds with the introduction of a pack of wolves, a peacock and tiger-butterfly. A strange and darker tone leads her into a confrontation between the tiger and a wolf, intercut with images of meat and teeth, forming a montage, supported by percussion and growls, until the tiger is “literally screwed up” into a ball of paper. The paper is then “unscrewed” revealing a mythical warrior woman, a twist on the Hindu goddess of death, life and creation. She slaughters the wolf violently. We hear machete sounds and blood splattering. It is visceral and violent. The woman runs, but trips and falls down as the train reappears. She finds a door and walks through, and out of the train, which is now stationary, in the same location as when the film started. Unsure, the woman heads towards a nearby bridge, which creaks unnaturally. The butterfly reappears and flies across the bridge. The woman follows, the creaking becomes more pronounced, and more metallic, as they “crossfades” into the train heading towards her. The film cuts to black, suggesting she is being run down by the train, or in the same way you are often “jolted” out from a dream, the train sound effects could be the trigger for her to wake up.

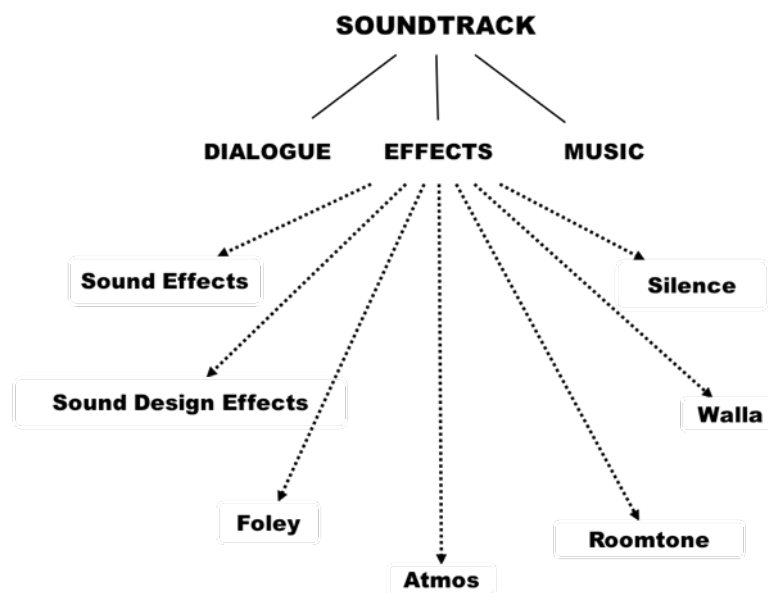
### CHAPTER 3: CONTEMPORARY SOUND DESIGN

The role of “sound designer” is now commonplace in contemporary film production, although not always recognized; the Academy presents awards for “Best Sound Editing” and “Best Sound Mixing” (Gray, 2016). This is partly due to the collaborative nature of soundtrack creation and the misconception of sound as a technical discipline. It’s still quite rare to see “sound designer” as a film credit, and those responsible for sound design are often listed as “sound editor.” When directors use “sound designer” on film credits, it’s in acknowledgment of the design and editorial work that goes into creating a soundtrack. Filmmaking is both artistic and technical; the most successful directors know this and employ sound to its full capacity. In the early days of cinema, technology was limited, and most live-action films were shot in controlled environments, usually on a sound stage, with everything, including sound effects, recorded. As a result, the postproduction phase was less intensive than it is today. Like in radio and television drama, a desire for realism led to more films being shot on location, which made sound recording more difficult and intensified the need for greater postproduction sound work. The first films relied more heavily on music (“silent film”), and then dialogue (“the talkies”), and there were few sound effects. The art of filmmaking developed as technology and associated skills developed, which resulted in greater experimentation. Consequently, this expanded the possibilities and complexities of both film sound and visual design. Peter Jackson’s remake of *King Kong* (2005), for example, looks and sounds nothing like the original film.

## THE SOUNDTRACK

### Dialogue, Music, and Effects

The soundtrack, often credited with being up to 70 percent of the picture or film experience, suggests a measurable constant (Beauchamp, 2005). Sound can be 0 percent (complete silence, and just picture) to 100 percent (just sound, with no pictures, just a black screen), and any figure in between. Each element of the soundtrack can function as a storytelling device, which is why understanding the various elements and the potential for interplay between sound and image helps generate ideas for how a film could or should sound. Typically, the soundtrack is defined as dialogue, music, and sound effects, which is an oversimplification, particularly in the case of sound effects. The soundtrack comprises dialogue, sound effects, sound design effects, Foley effects, walla, atmosphere, room tone, music, and silence. While it was once a singular (or mono) track, contemporary soundtracks can be hundreds of tracks and thousands of individual sounds. Figure 3:1 illustrates the various elements, or sub groups that comprise a soundtrack.



*Fig 3:1 The various elements of a soundtrack*

## Dialogue

Dialogue is a form of communication from characters or actors. Dialogue can express character and convey thoughts, emotions, and intentions. Dialogue is used to reveal the characters and sets the mood or tone of a story, while also providing direction and advancing the narrative. Synchronized dialogue is on-screen, visible, and typically recorded during production in the case of live action, or before production in animation, which helps to aid in timing and lip-synchronization. Dialogue recordings (or scratch tracks) for animation are often temporary and replaced with higher-quality recordings from voice artists at a later stage. Non-synchronized dialogue can be on-screen and off-screen. This includes additional vocal material such as grunts, groans, mumbles, breaths, coughs, and laughter. In animation, it's especially important to cast the right voice for the character, character design, and type of film. Animation directors always want authenticity and for the vocal elements to *belong* to the character. Many animation directors will define animation as being action or movement, and arguably the overuse of dialogue can be seen in a negative light. Both live-action and animation directors often advocate for “pure cinema,” which is storytelling through sound and image, not overreliance on dialogue.

Location sound (or production sound) is audio material, such as dialogue, that is recorded on location at the same time as the recording of image (principle photography). Automated dialogue replacement (ADR), or looping, is the process of re-recording dialogue due to problematic recordings, which is very common in the production of live-action films. The priority for production sound is capturing good quality dialogue. Microphones used for location dialogue recording are highly directional, therefore designed to capture dialogue and eliminate background sounds. Location sound recordists record separate recordings of room tone and atmos as a standard practice, and sometimes Foley and sound effects depending on the schedule and feasibility of the location. Sound effects and design material are usually recorded separately by sound designers and specialist recording teams. Location sound

practitioners encounter a wide array of challenges during a production shoot. What is being shot is considered the priority, not what is being recorded, which creates issues for postproduction. Ironically, it's more expensive to do ADR, and many argue that no matter how technically correct, ADR rarely measures up to original production dialogue. ADR often fails to match the energy and realism of on-set performances. The process of ADR in live-action film production is much the same as replacing prerecorded dialogue for animated films. In animation, "scratch tracks" are usually recorded prior to storyboarding and rerecorded later.

Dialogue also encompasses voice-over (VO), or narration, and other material such as telephone conversations and radio or television broadcasts. VO and narration typically address the audience directly (non-diegetic sound), as opposed to dialogue from within the film world (diegetic sound). VO usually has a commanding presence in a soundtrack and will always dominate the sound mix. VO and narration are often the voice of the main character, like in *The Tell-Tale Heart* (Parmelee, 1953), and are generally delivered in the first person (in English, "I," "we," "me," and "us"). A narrator can also be a person external to the story, someone who has a more complete knowledge of the events and characters in the film than the characters themselves. In this case, the narrator is invisible and delivers in the third person (in English, "he," "she," "it," and "they").

Dialogue can also be sound design. King Kong, R2-D2, Chewbacca, and WALL-E are good examples of where sound design and dialogue intersect. The voices are designed. Dialogue can also be "gibberish." The Minion voices in *Despicable Me* (Coffin & Renaud, 2010) are co-director Pierre Coffin speaking gibberish pitched up. In the first film, very few words have meaning, but as the Minions became more central, words were added to help carry the story. Their language is a mix of Chinese, Japanese, Korean, Italian, French, and Spanish. Coffin describes it as gibberish, with a magical rhythm and melody, which makes the nonsense make sense. We understand



the intent, which is communicated through the use of voice and variations in rhythm, speed, intonation, and pitch.

### **Sound Effects**

Sound effects (spot, sync, or hard effects) tend to be the primary up-front sounds that sync to important events, highlight drama, and help tell the story. Sound effects are also used narratively, to draw the attention of a character to something off-screen to preempt something. A common misconception is that a sound effect is a single sound. Sometimes this is the case, but generally what's perceived as a single sound effect is a number of sounds mixed and/or edited together. Every sound effect in a film is considered, in the same way everything you see in a frame is considered. Sound effects make an event or action feel "real." If we see someone being thrown through a window, we expect to hear it. The glass is fake; it's the sound of real glass that makes the event "real." If we heard the sound of fake glass, or no sound, or the wrong type of glass and impact, the illusion of reality would be broken. Sound effects also include specific effects like bird chirps, used to create atmos tracks.

### **Sound Design Effects**

Sound design effects (and/or elements) tend to be categorized as non-naturalistic and are sometimes called specialty effects; they are designed for imagined objects and places. However, they are frequently combinations of naturalistic, musical, and generated sounds. A sound effect can also become a sound design effect or atmos. A single piano note manipulated beyond recognition and mixed with wind can give wind a "voice" or make a scene "feel" eerie. In the literal (effect) sense, it's wind, whereas the subtext or "feel" (sound design effect) is eerie. The sound of wind can be created through recording the friction of materials (a canvas bag dragged across the floor), the effect of wind (rustling of leaves), custom-built wind machines, and/or the use of synthesizers. Sound design "textures" such as rumbles and drones can also feel like music or score when they have a perceivable musicality and/or rhythm. An example

of how and where the terms “sound effect” and “sound design effects” overlap is in the creation of an effect like a laser gun. It’s a gun, but it doesn’t exist in reality so cannot be recorded. It’s designed by combining real gun sounds with other sounds and synthesized and/or processed sounds.

### **Foley Effects**

Foley effects are natural detailed sounds associated with people and movement: sitting on a chair, placing a plate on a table, paper folding, glass breaking, footsteps, rustling of clothing. The technique is named after Jack Foley, who established the process of recording “acted” sounds such as footsteps and clothing rustles. In live-action films, when the dialogue is replaced so is everything else, which includes Foley. Animation, on the other hand, starts as a blank canvas, and Foley helps create a world that’s believable and feels authentic. Foley adds a physicality. Foley effects tend to be relatively subtle—a teaspoon clipping the edge of a cup, the jingle of keys, and the unlocking of a door—which helps connect the audience to characters and immerse the audience in the story world. Doors are considered Foley effects and sometimes sound effects. A door opening is not just one click of a latch, so like sound effects, Foley effects will also comprise a number of different sounds. A door can also be a sound design effect, for example the door of a spacecraft, which is a combination of Foley, sound, and sound design effects. Foley can be used narratively, to draw the eye to a specific detail and help define a character. If in a scene, a character hears footsteps from behind while walking down a dark, quiet alley, the footsteps suggest he or she is being followed. If the footsteps sound like stilettos, the audience would assume or “know” the character is being followed by a woman.

### **Atmosphere**

Atmosphere (abbreviated as “atmos”) and also called ambience, or backgrounds, are the sounds of a location, environment, or space, such as a city or a forest. Atmosphere signifies locations, settings, time of day/night, and historical time periods, and helps

convey the story and immerse the audience. Atmosphere establishes a scene and works editorially by staying constant across a picture cut to indicate to the audience that no change of time or location space has occurred. When atmosphere changes abruptly, it indicates a change in location or time to the viewer/listener. Atmospheres are generally exterior environments and consist of added sound effects and often walla, but they can also be interiors, non-naturalistic, and perceived as sound design effects.

### **Room Tone**

Room tone is the sound of a room or interiors, which is the presence of subtle sounds created by the movement of air particles in a particular volume. All rooms are different sizes, shapes, and are constructed from different materials so have different acoustic properties. Interiors are usually reverberant, which indicates the size of the enclosed space. Room tone is generally naturalistic, but like atmos, room tone can be sound designed. For example, combining sound design textures with room tone can make a room feel claustrophobic or add a sense of foreboding. Room tone is recorded on location and used in live-action films to match and intercut with production sound to smooth out any sound edits. For ADR and animation, adding room tone gives realism and authenticity to dialogue recorded or re-recorded “dry” in an acoustically treated studio.

### **Walla**

Walla is human vocal sounds such as the murmur of a crowd or background conversations in a café. Walla is added to a soundtrack and usually to create realism and/or to “cheat” how many people are in a given space. The word “walla” was adopted from the early days of radio for the sound of a crowd in the background. It was discovered that if several people repeated “walla, walla, walla” it sounded like the indistinct chatter of people talking in the background. Today walla is devised using

real words and conversations and is sometimes treated as dialogue, depending on the degree of presence in the mix, relative to the visuals.

### **Silence**

Complete silence is very rare in a soundtrack. More often than not, something described or written into a script tends to be expressed as something emotive like “eerie silence” and not actually conceived as pure silence. Silence is the total absence of sound, whereas “eerie” suggests sound design, and something *unsettling*. Silence is typically used to express the absence of dialogue, music, and key or “upfront” effects. When used “silence” can be a very effective, dynamic, and emotive storytelling device or effect. Silence (or near silence as is often the case) can make what happened before or after an event feel bigger and more dramatic, and focus the viewer/listener on the emotional dimensions of a scene.

### **Music**

Music is either source, therefore comes from within the story world and generally from a source visible on the screen (or “diegetic”), or score, which means external to the story world (or “non-diegetic”). A composer creates a score, but a film score can also include preexisting music tracks. Music adds to the emotional quality or effect of a film, and often the most effective scores “work” below the consciousness of the viewer/listener. Most film scores are “underscore” and are used to support atmosphere, plot and narrative and/or reflect the emotional aspects of the narrative and/or characters. On the other hand, music can also drive a scene, sequence, or montage. Music can also help establish historical/period, geographical, social and cultural characteristics of a film. Scoring can involve anything from a 100-piece orchestra to a simple trio or solo instrument. Scores are recorded on scoring stages or in smaller music recording studios, depending on the arrangement and budget.

Music mixers are in charge of recording and mixing music and delivering music stems to the dub stage for final mixing. Common in film scoring is the leitmotif, a term

coined to define a theme of easily recognizable melodic, rhythmic, or harmonic identity used in connection with a certain character or incident and used repeatedly, therefore reminiscent of the original association. “The Imperial March (Darth Vader’s Theme)” is a classic example of a leitmotif. Thematic music is also frequently used for openings and closings, transitions and credits. Quentin Tarantino uses songs to help him find the personality and spirit of a film, and often during the concept and writing phase. Music tracks and songs are selected for their lyrical content and/or genre because they suit the situation, period, and/or character(s). Sound design can also serve as music, particularly if it involves using elements that are or were musical instruments, in the same way that *musique concrète* is considered a form of composition.

### **THE SOUND DEPARTMENT**

In the media and entertainment industry, the size and scale of the sound department depends on the scale of the project and corresponding budget and schedules. Aside from production sound (location sound), there is minimal difference between live action and animation; both are storytelling mediums, with images that move and have sound. On live-action films, sound recordists record dialogue, wild takes, atmos, and room tone. On animated films, games, and many live-action films, separate recording teams specialize in sound effect recording, or the sound designer(s) working on the film will record sound effects and design material. Key creative staff include the supervising sound editor, sound editors (sound designers), and re-recording mixers. The sound department on a feature film can mass to more than thirty people, sometimes even more, and with overlapping roles. In *WALL-E* (Stanton, 2008), Ben Burtt is credited as character voice designer, sound designer, re-recording mixer, and supervising sound editor.

### **The Supervising Sound Editor**

The first postproduction sound person brought onto a film is the supervising sound editor (or a senior sound designer), ideally during preproduction, for creative planning and the hiring of talent. The supervising sound editor works with the director, producer, and editor and is responsible for managing the sound department. He or she coordinates sound editors, designers, Foley artists, mixers and directs the creative contributions of the postproduction sound team. The supervising sound editor also handles administrative duties like planning and monitoring the postproduction sound budget, securing equipment rental, scheduling staff, and establishing the workflow of the department. On low-budget productions, the supervising sound editor may not be hired until the final picture edit, which is problematic, and undermines the quality and creative potential of work. In games and virtual reality film (VR), an audio director functions in much the same way as a supervising sound editor, but due to the complexity of working on games and immersive or interactive projects, the audio director is usually involved from the preproduction stage.

### **The Sound Editor (Dialogue, ADR, Foley, Sound Effects, Music)**

A sound editor is responsible for selecting, assembling, spotting, and tracking sound in preparation for the final mix. The need for sound editing developed from the early “talkies” and over the decades has become more closely aligned with sound design, which involves sound editing. The roles of sound editor and sound designer are now interchangeable, as they both involve design. In the case of large-budget films, editors tend to specialize in a specific area: dialogue, effects, or music editing. Dialogue editors work with the dialogue recordings and/or ADR; music editors edit the music tracks; and the role of sound effect editors is usually split between the various categories of sound effects. On small projects, sound editors/ designers may handle all three areas, premixing, and sometimes the final mix.

### **The Sound Designer**

A sound designer is defined as someone who practices the art of sound design, which can range from designing individual sound or sound design effects for a film or game to a complete soundtrack. Commercial feature film soundtracks are created by a number of sound personnel, whereas an individual or a small team produces a short film or independent feature soundtrack. A sound designer conceptualizes, designs, and supervises the sound for a film in much the same way that a production designer is responsible for the look of a film. A production designer is concerned with visualizing the script's thematic, emotional, and psychological concerns. Sound designers share the same concerns. The title of sound designer in film is often interchangeable with the designation of supervising sound editor. For interactive projects such as games, the role of the sound designer is similar to the role of a film sound designer. Game sound designers create the sound effects that comprise the game soundtrack. Low-budget projects typically employ a sound designer capable of handling everything from recording to mixing.

### **The Re-recording Mixer**

A re-recording (or dubbing) mixer mixes the dialogue, sound effects, and music premixes to create the final version of a soundtrack. The term "re-recording mixer" refers to the process of taking material that has been recorded once and recording it again. Re-recording mixers are responsible for making sure the soundtrack is both technically and stylistically "correct." During production and postproduction, sound editors, sound designers, sound engineers, and music editors assemble material ready for mixing. The first part of the re-recording process begins with the preparation of "premixes," which involves the premixing of all the separate elements into a more manageable form. Premixes can also be divided further if the mix contains a large number of sound effects; for example, the effects premix can be broken down into separate spot or Foley effects premixes. Dialogue, music, and sound effect premixes are then brought into the final mix stage. During the "final mix," the re-recording

mixers combine and balance the various soundtrack elements, which involves volume automation, adding effects, and spatial positioning. In the same way, there is an overlap between sound editing and sound design, re-recording mixers work with complex layers of sound, technically, editorially, and aesthetically. Re-recording mixers are usually employed by audio postproduction facilities or work on a freelance basis. On small- to medium-budget films, re-recording mixers may also work as sound editors and designers. A full-size mixing theater or dubbing stage is used for mixing feature films that are going to be released in movie theaters, which is done in consultation with mastering engineers and Dolby consultants.

## **APPROACHES TO SOUND DESIGN**

### **Modes of Thinking**

Sound design can suggest a mood; add or withhold information; evoke a feeling; convey meaning; set a pace; indicate a geographical location; stimulate our visual imagination (or mental imagery); specify a historical period; clarify the plot; define a character; connect otherwise unconnected ideas, characters, places, images, or moments; heighten realism or diminish it; heighten ambiguity or diminish it; draw attention to a detail or away from it; signify changes in time; smooth otherwise abrupt changes between shots or scenes; emphasize transitions; describe an acoustic space; startle or soothe; and exaggerate action or mediate it. Sound can accomplish many of these functions independently (radio drama, for example), but the combining of sound and image is the power in storytelling.

While sound design relates to story and design, in the case of experimental works, a purely conceptual or thematic approach is often a more appropriate methodology. Sound can be literal and mimic what is seen on the screen. Sound can also be “internal” and mirror the subconscious or psychological dimensions of a narrative, character, or story world. Although individual sounds may not be identified as such, the mix of seemingly disparate sounds can “work” visually, conceptually, and



aesthetically. The “effect” of many sounds combined can also trigger conceptual resonance. “Resonance” is a term frequently used in audio-related fields and explains the tendency of a system to oscillate with greater or enhanced amplitude at the natural frequency of the system. A more general use of the term is to describe the emotive significance of an association. While the obvious see it/hear it approach to sound design will add realism, a completely “literal” approach is not necessarily the most emotive, effective, or creative use of sound.

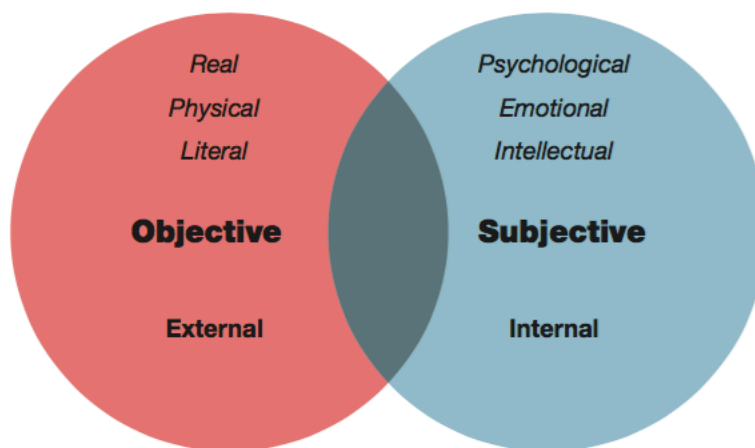
As soon as the sounds of the visible word, reflected by the screen, are removed from it, or that world is filled, for the sake of the image, with extraneous sounds that don’t exist literally, or if the real sounds are distorted so that they no longer correspond with the image—then the film acquires a resonance. (Tarkovsky, 1989, p. 162)

A basic principle of design is materials and composition, and typically a sound designer will start with a raw sound, usually sounds, that form the “building blocks” or aural palette for the creation of sound and sound design effects. A raw sound could be the right sound or starting point, but rarely on its own or in its original state. The process of creating sound and sound design effects is similar to painting and sculpture. It involves selecting, creating, and shaping the aural palette to define the aural aesthetic of a film. Understanding the “ingredients” of a sound is akin to defining what pigments, and amounts of them, are combined to create a new paint color. Image elements have similar sound equivalents; color and hue are akin to frequency, pitch, or timbre. Sound has its own distinct terminology but often parallels or has close associations with image terminology. The process of identifying, and rationale behind audio selection, can be complex. There is no right, wrong, or singular path; it is dependent on story, visual aesthetics, and emotional context. We relate to sound emotionally and subconsciously, which is why articulating how a sound effect should sound is difficult. Often it is easier to define something relative to how it should

“feel.” “Dark,” “cold,” “frightening,” “light,” and “warm” are words that evoke certain sound associations. Words can help trigger ideas. Most sound designers describe the process as involving imagination, experimentation, and trial and error. The audio palette is extensive and sound can be very deceiving. Sometimes a sound will not feel, sound, or look right when it could in fact be the right sound(s), but too loud, in need of equalization or pitching up or down. The envelope of the sound itself may need reshaping. When it feels right, it is right, but if it feels wrong, then it’s back to the “drawing” board.

A well-known thought experiment asks this hypothetical question: If a tree falls in a forest and there is no one to hear it, does it make a sound? Objectively, the answer is yes, because a falling tree would make a sound. On the other hand, the answer could also be no. How can something exist without being perceived? Sound is only sound if someone actually hears it. The answer depends on the way the word “sound” is interpreted. Sound is used to describe a physical phenomenon and a human experience, because hearing is a mechanical phenomenon of wave propagation and a sensory-perceptual event. Most aspects of sound engineering are concerned with sound from an objective perspective, but soundtracks are created for audiences, audiences are people, and people respond to sound emotionally. If a tree is seen falling soundlessly, an audience may react negatively because they see and expect to hear something: branches cracking and splintering, and the impact of the tree hitting the ground. If there is a reason for silence—for example, if it is being used as an *effect*, which is understood by an audience— then the reaction is likely to be positive. People are different, but there are commonalities in the way people respond to sound. So, when designing a soundtrack, if something “feels” wrong, then it probably is wrong, and will be perceived as wrong by an audience.

In film, objective sound is understood as sound that the physical world generates and is considered literal. Objective information is fact-based, observable, and measurable. Subjective sound mirrors the world inside our minds, affected by the processes of hearing and perception, and considered psychological. Subjective information is based on opinions, interpretations, and emotions. Sound designers oscillate between these two states of consciousness, which often overlap. How should something sound from a “real-world” physical, literal, and external perspective, and how could something sound from a psychological, emotional, intellectual, and internal perspective? Figure 3:2 illustrates these two distinctive ways of perceiving sound.



*Fig 3:2 Perspectives on sound*

### **Real and Literal Sound**

Realistic sound is sound that would logically and authentically exist in the world depicted on the screen. There are times when the real and literal sound is appropriate, for example the sound of a car arriving. But real sound is also used narratively and expressively. For example, a knock on the door is a real sound, but is it delivered with a clenched fist or a polite tap?

If we're on the other side of the door, we don't see the knock, but the sound of the knock could tell us something about the person doing the knocking. Real sound can also be fabricated. In *Saving Private Ryan* (Spielberg, 1998), Gary Rydstrom scraped concrete to create squealing tank treads, with rhythms from motors for the German tanks. While not authentic, audiences and war veterans perceived the sound design as authentic. So, while real and literal sound are preoccupied with authenticity and physicality, how something is designed, why, and from what is often a fabrication. In defining how something should sound from a literal perspective sound, designers think about it from a physical and objective point of view.

- What's it made of?
- How does it work?
- How fast/slow, big/small is it?
- What environment is it in?
- Will the audience accept/believe it?

### **Hyperreal and Surreal Sound**

Hyperreality is described as the inability of consciousness to distinguish reality from a simulation of reality. In sound design, that takes the form of heightening or exaggerating "reality." The effect can be unsettling, can add an emotive and psychological depth, and can be used to draw the eye/ear/mind to a specific detail. When pushed to the extreme, the hyperreal can become surreal, which is often associated with nightmares, dreams, flashbacks, memories, altered states, and hallucinations. In defining how something should sound from a hyperreal perspective, sound designers think about it from a physical and beyond physical, into a more subjective and emotive, point of view.

- What should, and then what could it sound like?

- What's it made of, and do I want to exaggerate that?
- How does it work, and do I want to exaggerate that?
- How fast/slow, big/small is it, and do I want to exaggerate that?
- What environment is it in, and do I want to exaggerate that?
- What do I want the audience to accept/ believe/feel/think/see?

### **Psychological and Emotive Sound**

Psychological and emotive states can be difficult to convey and communicate in pictures alone. The combining of real, generated, and manipulated sound, from a psychological and “internal” position, can be dramatic and emotive; can set up a mood, tone, or idea; and can place the audience inside a character's head. Certain types of sounds and different frequencies evoke certain emotional responses; low frequencies suggest *danger*, *foreboding*, *doom*, *dread*, and *panic*, while higher frequencies can suggest *pain*, *isolation*, and *anxiety*. In defining how something should sound from a psychological and emotive perspective, sound designers think about it from a narrative-emotive point of view.

- What is the character's emotional state? Why?
- What do I want the audience to think, know, or suspect?
- How do I want the audience to feel and react?

### **Metaphorical/Figurative Sound**

The word “figurative” comes from the French word *figuratif*, and is frequently associated with the “metaphorical” and relates to something that isn't intended to be understood literally. Dialogue is usually the literal and informative part of a soundtrack and music typically perceived as the emotive. Metaphors in film are usually thematic and a combination of sound and image, often reliant on the approach to picture editing techniques, primarily the juxtaposition of images and sound.

Conceptual metaphors are often used to communicate emotions, abstract ideas, and “invisible states.” In defining how something should sound from a metaphorical perspective, sound designers think about it from a more abstract and representational point of view.

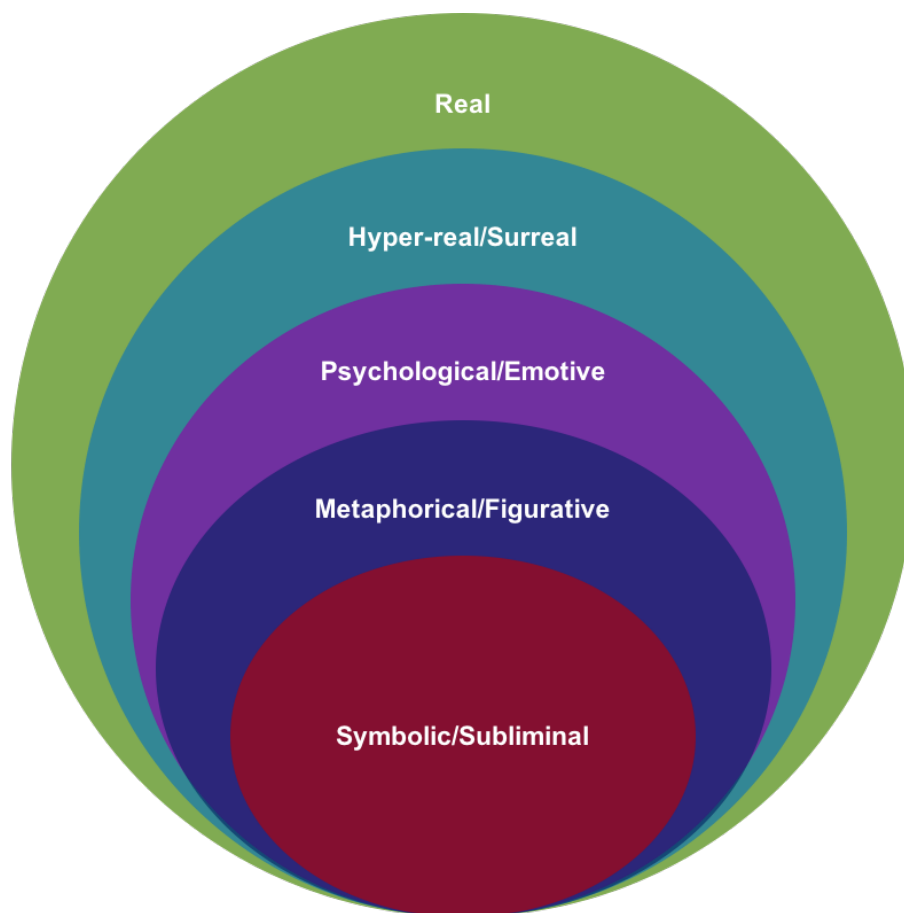
- What are we seeing and not seeing, and what could we hear?
- What do I want the audience to think, know, or suspect?
- How do I want the audience to feel and react?

### **Symbolic and Subliminal Sound**

Symbolic sound is generally abstract and not usually associated to a given visual; for example, the sound of thunder could suggest something bad is about to happen, even though we don’t see thunder, so there’s no visual reference. The sound can be low (in terms of volume) in a mix and barely discernible, to the point of being subliminal. Viewers can see and separate elements in a picture, but they hear the soundtrack as a whole, despite its being constructed from many elements. Sound affects audiences subconsciously, and symbolic or subliminal sound creates an emotional involvement and/or suggests an underlying subtext.

- What is the character’s emotional state? Why?
- What are we seeing and not seeing, and what could we hear?
- What do I want the audience to think, know, or suspect?
- How do I want the audience to feel and react?

Figure 3:3 further illustrates how sound can be “unpacked” and approached from various intellectual and aesthetic perspectives.



*Fig 3:3 Varying approaches to sound design*

There is no singular or definitive path to designing a soundtrack; real can become hyperreal and function symbolically. All “categories” are narrative, aesthetic, and emotive choices. It depends on the type and style of film. The goal is to design the film with sound and image in mind, and the question is always, what “works”? The Imperial Walkers needed mass and weight. If they were real (and not miniatures), what would they really sound like? In *Star Wars* (Lucas, 1977), there is sound in space, which violates the law of physics. Objectively, sound will travel through any medium (air, water, gas), but not a vacuum, because sound needs a medium to travel

through. Silence can be used dramatically; however, a big, low rumble tends to feel more dramatic and emotional.

In *2001: A Space Odyssey* (Kubrick, 1968), space was treated from a scientific perspective, but in discussing *Star Wars*, Lucas wanted impact and drama. He wanted the sound design to be emotionally right, as opposed to scientifically right, and adopted the position that they were using music and not justifying where the orchestra comes from, therefore did not need to justify the sound design. A slightly different approach was adopted on *Gravity* (Cuarón, 2013). Sound was designed so the audience would hear sound effects the same way the characters did. Space is silent except for when the characters are touching something and form a conduit. The simulated spacecraft, tools, and other objects needed to look and sound real, which involved recording similar types of machinery: robots that make cars at General Motors and air conditioning units for inside the spacecraft. Guitars were submerged in water and their strings rubbed with various items, recorded with underwater and contact microphones to become the sounds for when Sandra Bullock's character is caught up in a parachute. The background radio chatter was not prewritten dialogue performed by voice actors but recordings of a group of NASA employees. Interesting to note is the recent debunking of the notion of silence in space. According to NASA, sound in the form of electromagnetic vibrations does exist in space, and they recently designed special instruments to record these vibrations as sound. The results are defined as complex interactions of charged electro-magnetic particles from the solar wind, ionosphere, and planetary magnetosphere. The audible results sound like sound design textures designed to emotively and dramatically accompany the corresponding visual images of planets. Planet Earth has its own eerie "voice," so the approach to sound in *Star Wars* might actually be more scientifically correct than previously thought.



I usually first think, if these objects, places, or robots, or machines really existed, what would they sound like? How would they be powered? What would be the actual physics of how they work, but if I find the sound isn't working within a scene, I'll abandon the science and go with what works emotionally. (Burt in Milsom, 2008)



*Fig 3:4 Gravity (2013, dir. Alfonso Cuarón), Warner Bros., Esperanto Filmoj, Heyday Films*

### Design Duality—Audiovisual Synergy

Films that are held up as examples of creative sound and visual design tend to employ creative audiovisual arrangements. For example, *Raging Bull* (Scorsese, 1980) is designed for the audience to “see” the world through the “eyes” of Jake LaMotta, a paranoid, possessive, violent boxer. The way the film was written and visualized, shot, and edited also opened the door for hearing that world. When Jake LaMotta fights Sugar Ray Robinson, the sound design by Frank Warner combines silence, crowd noise, cheers, and groans with VO commentary, animal roars, bird shrieks, rumbles, punches, blood splatters, and gritty camera flashbulbs. The sequence is audio-visually stylized and visceral, which allows the audience to see-hear-feel the blows LaMotta delivers and receives in the ring (and outside of it). Similar techniques can be seen and heard in more recent films like *Snatch* (Ritchie, 2000) and *Fight Club* (Fincher, 1999).

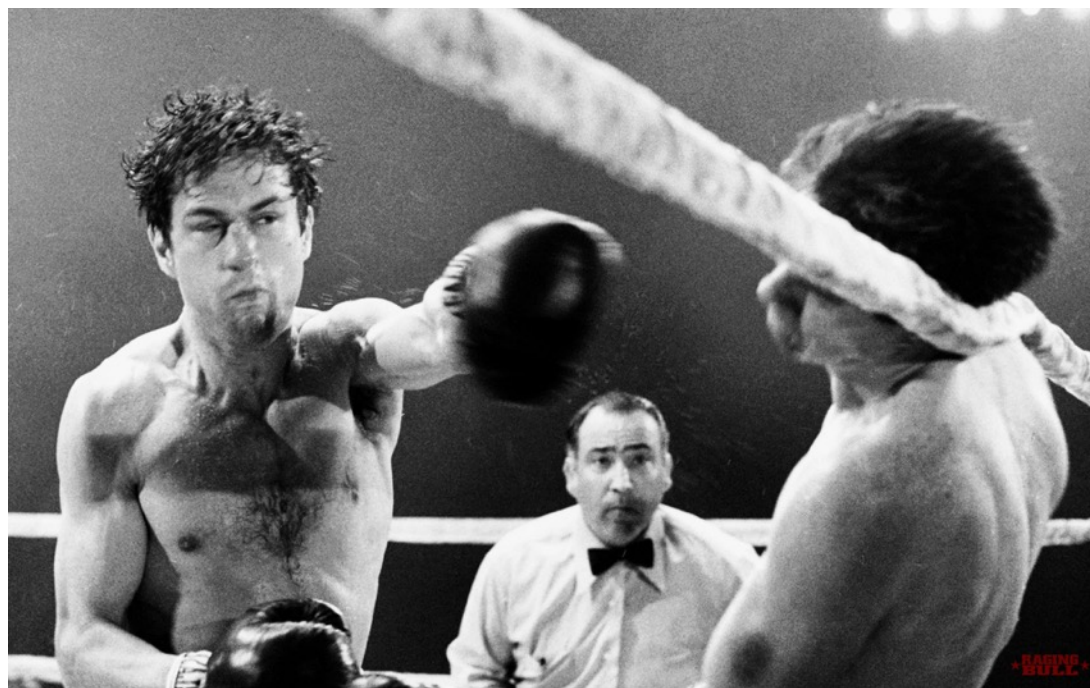


Fig 3:5 *Raging Bull* (1980, dir. Martin Scorsese), United Artists, REX, Shutterstock

As many filmmakers will agree, filmmaking is the blend of many interrelated and overlapping skills and processes. On *Attack of the Clones* (Lucas, 2002), Ben Burtt was the sound designer and picture editor, working on both sound and picture simultaneously. During picture editing, he got ideas for sound effects and made sure the pictures allowed sound ideas to be integrated. He spent a few hours to a few days working on sound design and then edited those designs with the pictures. Conversely, adding sound gave him ideas for picture edits. The process of working back and forth, between sound and image, also meant he was not distracted by sound that was unrealistic or lacked credibility.

I learned over many years of sound how to enhance drama with layers of sound. Now as a picture editor, I am asked to enhance drama with layers of images. The process of building up a complete dramatic sensation with sound is the same one I apply to picture editing. The key element in filmmaking is the juxtaposition of sound and picture elements to produce a desired emotional response in the audience.  
(Burtt, n.d.)

Thinking and working audiovisually is beneficial on a number of different levels. Ben Burtt adopted a similar approach to sound design and workflow on *WALL-E* (Stanton, 2008) by working alongside the visual artists. Burtt created voice and sound effect sets as auditions for Andrew Stanton, followed by montages from selected material (Milsom, 2008). Sound design started early and developed through the use of rough reels and to a level that would normally occur in postproduction. Stanton wanted speech and sound effects to feel like they were coming from their functions as machines, either a chip on board that synthesized the voice or a sound effect like the squeak of a motor to indicate how a character was feeling. Burtt blended human and synthesized elements to create their “voices” in a similar way to how he created R2-D2. He also drew from his experience designing sound effects for *Star Wars* in the

creation of other effects. Striking a very long slinky made the sound of EVE's laser. The howling wind of Earth at the beginning of the film is a recording of Niagara Falls, reverb, with some feedback and filtering. WALL-E is "low tech" (analogue), therefore a combination of motors, squeaks, and metallic sounds, while EVE is "high tech" (digital), therefore a combination of more synthesized and sleek sounds. Burt is the voice of WALL-E, Elissa Knight is EVE, Sigourney Weaver is the ship's computer, and the Macintosh text-to-speech engine "MacInTalk" is the voice of AUTO. The robots speak in sound effects and processed word fragments. Subtle aural-visual intonations add layers of meaning, which communicate character, story, and emotion. A mixture of song and score from composer Thomas Newman enhances the film's distinct narrative aesthetic.

In summary, there is no definitive path to designing a soundtrack, but there are parallels with visual disciplines, and part of the sound designer's skill set is the ability to visualize. While it isn't common to be working on both sound and picture simultaneously, *thinking* about sound and picture simultaneously will generate ideas that can then be incorporated into a script. Sound is editorial; it affects story, but sound design involves more than just determining what to hear and when; it also shapes the emotional content of a scene. How something should sound from a "real-world" perspective could be relatively obvious. How something should sound from a psychological, intellectual, and emotional perspective tends to involve a lot more trial and error. The audio palette is extensive and the possibilities endless. Having a good understanding of the narrative and the intended aesthetics is vital, but emotional responses also come into play. It's important to talk about sound and picture, and it's important to experiment and try different things. Having meaningful conversations and exchanges is how creative collaborations evolve.

### **T is for Talk – Horror Short (online)**

The ABCs of Death is an anthology horror comedy film comprising 26 different short films, as 26 chapters. Different directors spanning fifteen countries produce each film. Each director chooses a word, and then creates a low budget (under \$1,000), four-minute story, involving death. *T is for Talk* depicts the entrapment and torture of helpless captives in a forced experiment by an unseen machine.



*Fig 3:6 T is for Talk (2011, dir. Peter Haynes)*

Central to the story is the Machine, which we do not see, only a façade, which is a neon sign, and an arm that crushes its victims if they talk, or do not talk, on command. The film opens in an unknown environment, a room, with six people handcuffed to a railing, silent until directed by the sign to talk momentarily, and then fall silent. This repeats as the camera focuses on each individual “participant” struggling to comply. One of the participants attempts to defy the Machine and is electrocuted for his efforts. One by one they are all crushed by the unseen Machine, until the last woman, who is then directed to laugh.

The online clip has the full mix, followed by production sound only, so that the effect of sound design can be 1) be compared to a version with no sound design and 2) to highlight how most live action films “arrive”, which is generally with production dialogue only. The film was shot quickly, under budget, in a garage, with handmade props. Sound design helped to create (cheat) the environment; rumbles and drones with a metallic edge, for the “room tone”, and the Machine, which was not visually apparent. Does it “live” inside the walls of what appears to be some kind of metal chamber or cell? Is it “self-aware” or is being operated by someone? How could, should the neon sign and “arm” interact? How does it *work*? Given a tight deadline, I decided it lived in the walls, was self-aware, and would physically be comprised of metal, robotic, and mechanical parts. The Machine was then “built” from metal bangs, metal doors, screeches, creaks, groans, crashes, rumbles, padlocks, gun cocks, motors, camera motion control effects, chains, servos, electrical hums, buzzes, and arching, metal grate impacts, camera flashes, morgue trays sliding, ratchets, steam and swords. More obvious was the effect of the Machine, it “pulverisers” its victims in a way that is visceral; punches, body hits and slaps, flesh rips, bone cracks and blood splats, combined, and combined with the Machine sound effects. Sound design textures were used in “lieu” of music, which were originally individual drum and bass samples, re-imagined and processed to create tense textures, to underscore the tone of the film and key moments of “realization”. The films soundtrack is an example of how the many and varied approaches to sound design can be incorporated into a short horror film.

## **CHAPTER 4: PREPRODUCTION**

There are three phases that constitute the creation of a film: preproduction, production, and postproduction. The preproduction stage is when a project is defined, refined, and each subsequent stage planned for. In live-action films, this involves scriptwriting, script breakdowns, concept art, storyboarding, shooting scripts, pre-vis (previsualizations), location scouting, hiring of crew, talent, and equipment, organizing props and wardrobe, budgeting and scheduling. A production sound team is usually hired, and on medium to large-budget productions a sound designer or supervising sound editor is contracted during preproduction. Production involves principal photography (the shoot) and location sound recording, primarily dialogue recording for live-action film. Postproduction includes sound and picture editing, ADR, sound design, music, visual effects, compositing, grading, mixing, mastering, and encoding. In animation, a treatment is scripted, then storyboarded, scratch tracks are recorded, and story reels are created during preproduction. Animation production involves the design and creation of characters, sets, and props, which are animated, and in the case of 3D animation, virtual cameras capture shots. In postproduction, individual shots and scenes are edited together, compositing undertaken, visual effects added, sound design and music completed, and the final soundtrack is mixed, mastered, and encoded.

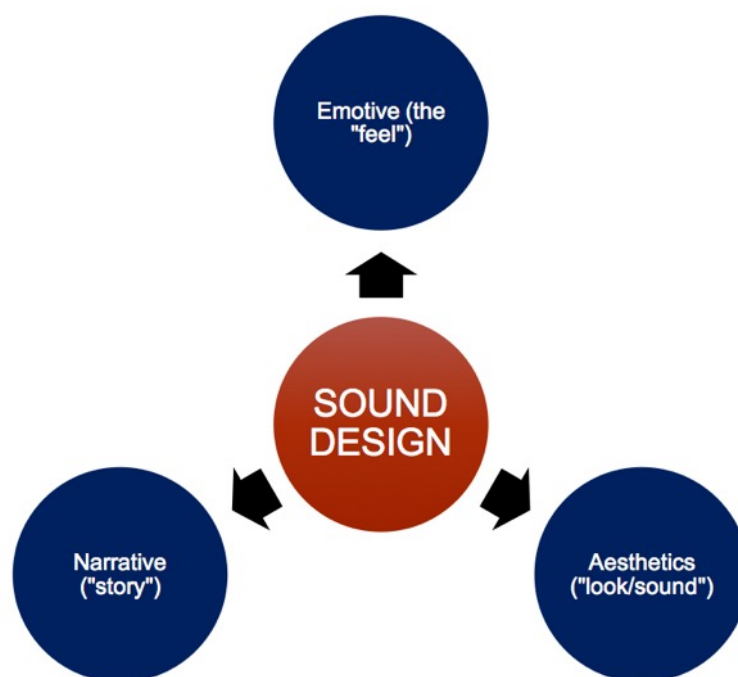
### **THE DEVELOPMENT STAGE**

In traditional live-action film, the preproduction and production phases focus primarily on the visual aspects of film production, but industry leaders such as Randy Thom advocate less of a division between production processes in general and greater sound-image collaboration throughout the entire creation process (Thom, 2003). Sound design has traditionally been perceived as a film postproduction discipline, but for sound and image to feel like a unified whole, the consideration of sound needs to be undertaken in preproduction. While some directors think creatively about sound,

many leave any serious consideration until postproduction, which is too late in the production cycle for active participation. The same situation applies to music. Each phase of a production affects the next, and as a film begins with a script, the time to really start thinking about sound is during scriptwriting and development.

Identifying what a film should sound like requires having an understanding of the narrative, aesthetics, and emotive intent. These are the three key considerations for sound designers when taking on a new project. The word “story” is a synonym for “narrative” and refers to the interpretation of the sequence of events described in the script. The word “look” is a synonym for “aesthetics,” which is often perceived as purely visual, but as film is audiovisual, aesthetic considerations incorporate the “sound” of a film. Narrative, aesthetics, and emotive devices can be any and all production elements, which includes sound. The approach to the narrative-aesthetic design of a film often defines the emotion, or “feel,” of a film. The word “feel” is a synonym for “emotion,” which relates to the characters, environments, and overall emotive impression, or effect, of a film. Figure 4:1 illustrates the key considerations sound designers face when considering approaches to a film's sound design.



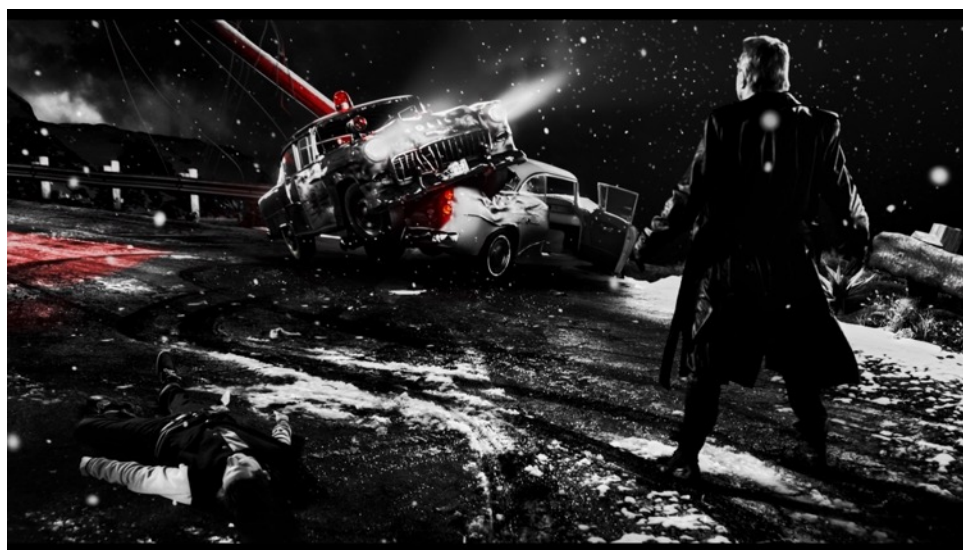


*Fig 4:1 Fundamental considerations of sound design*

### **Genre and Style**

Action, adventure, comedy, crime, gangster, drama, thriller, historical, horror, musical, science fiction, coming of age, war, Western, and fantasy are all common genres for films, web series, television shows, and games. Defining a genre gives people an initial idea of the type of film or story being proposed. Certain genres are associated with specific approaches or sound sensibilities, although it largely depends on the treatment of the film. Films can be a mix of genres and a combination of ideas—realistic, synthetic, artificial, or stylized. *Fantastic Planet* and *THX 1138* are both science fiction films but are aesthetically very different; the sound design in *Fantastic Planet* is predominantly synthetic and stylized, whereas *THX 1138* is realistic, artificial, and stylized.

An expression like “film noir” describes the style, mood, or tone of a film, which also suggests an intended aesthetic. Hollywood’s classical film noir period is generally regarded as starting in the early 1940s and is associated with crime or gangster genres and German expressionist cinematography. Also, dominant in film noir is the use of narration and stylistic sound design. A contemporary example is *Sin City* (Miller, Rodriguez & Tarantino, 2005). It has a “hyperreal-graphic” aesthetic, which is visually and aurally stylistic, and most visually stylistic films are aurally stylistic. Sound and image complement each other. Expressions like “abstract” or “experimental” normally relate to a more thematic approach to storytelling and audiovisual design. Many films are a mix of genre and style, but certain expressions will hint at a particular “vision,” which is useful for sound designers in conceptualizing sound ideas.



*Fig 4:2 Sin City (2005, dir. Frank Miller, Robert Rodriguez, Quentin Tarantino), Elizabeth Avellan, Frank Miller, Robert Rodriguez.*

### **Story and/or Theme(s)**

A story or narrative comprises three acts, which in the most simplistic terms is a beginning (exposition), a middle (conflict), and an end (resolution). Characters drive

the plot, while an underlying theme or themes hold the narrative together. Narrative scripts address a series of common questions that may not always apply to experimental or abstract works; however, a general theme and style can usually be identified regardless of the type of project. A theme is commonly understood as an idea that recurs and either encompasses or pervades a work of art. Experimental works are usually based around the exploration of something new, or a different way of presenting an idea, which opposes adherence to traditional or expected structures. *La Jetée* is a good example of an experimental film; it explores time, temporality, and movement through the editing of mainly still images and the use of sound. Despite the experimental aspect of the film, it still has a narrative. In experimental or abstract projects, there is usually an underlying theme or sense of narrative, which is also useful for thinking about sound design, particularly if there's also a specific or defined presentation method.

### **Story Development**

Before a draft script is written, there are a number of story development stages an idea goes through before it's realized as a script. Each step of the script development process gives specific insights to the story, the story world, and the characters. A script is often defined as a map or a blueprint. They are not detailed documents so can be interpreted or “seen” differently by different people. While some writers are articulate about sound in their scripts, it's not that common. The traditional film script format doesn't lend itself to communicating sound—not in an obvious fashion. Unless you are the scriptwriter, and depending on how a script is written, the “psychology” or subtext of a film may not be initially apparent. Sometimes the materials generated through the script development process can be more “telling” than the actual script. A synopsis, story treatments, outlines, descriptions of characters, and environments all provide useful information for triggering ideas. Pitch, story, and writer bibles can be helpful because they outline the premise, story world and tone, locations, and genre, and they include character bios, descriptions and insights, full episodes or episode

storylines, artwork, and sometimes a pilot episode. More recently, it's become common to create a teaser, pilot, or pitch-vis to introduce the premise, style, themes, locations, characters, key emotional relationships, and conflicts. These are all opportunities to explore potential ideas for sound.

### **Outlines and Treatments**

The first step in any project is having or coming up with a good story idea. After deciding on the basic concept or premise, the next stage is creating the synopsis, outline, and treatment. Each phase of story development extends the opportunities for conceptualizing sound and visual ideas:

#### **One-Line Synopsis (or Logline)**

One sentence that gives the most concentrated version of the story or its key event.

#### **One-Paragraph Synopsis**

A one-paragraph synopsis that defines the essence of the story—WHO, WHAT, and HOW. It sets out whose story it is, what his or her problem is, what he or she does about it, and the outcome.

#### **One-Page Synopsis**

Like the one-paragraph synopsis, the one-page synopsis deals with the WHO, WHAT, and HOW, but also establishes other key characters, their conflicts, the setting in time and place, and major turning points of the story. The one-page synopsis gives a clearer indication of the narrative structure: how the story begins, develops, and ends. The one-page synopsis also includes the event, the decisions and actions the characters make in pursuit of their goals, the obstacles they encounter and what they do about them, whether they win or lose, and where they end up. It's still a brief and compressed document, but it does give the reader a sense of the characters and their key choices and actions, which generally defines the characters. It gives the reader some *emotive* insight to the story.

## Story Outline

The outline expands on the one-page synopsis to include motive, cause and effect, and demonstrates the flow of the narrative—how it will be told on screen. Writers outline blocks of action, or plot points: the *opening/closing* (what is first/last seen/heard on the screen), the *inciting incident* (an event that changes the course of the main character’s life/journey), the *first act break* (marks the end of the setup and key characters have been introduced), *the midpoint* (the middle of the second act and a direction change), *the point of commitment* (the main character reaffirms commitment to his or her goal or quest), *all is lost* (the main character has experienced an extreme setback, and generally the end of Act Two), *the climax* (the main character has gathered his or her resources), and the *resolution*. Not all films adhere to formula of course, but writing a story outline helps clarify the story, which in turn helps everyone involved understand how the narrative is going to play out.

## Story Treatments

A treatment sets out the way a story is going to be dramatically and cinematically treated in terms of style and narrative. Like an outline, it’s also a “selling” document, but the main goal is to convince the reader that the writer has a firm grip on the story and how it’s going to be told. Treatments are widely used as a pitch document to outline story and character aspects of a proposed script, whereas outlines are produced as part of the development process. A treatment is usually a longer document that incorporates any sub-plots, indicating how they integrate and resonate with the main plot. Although the treatment is longer than the outline, it’s still a prose summary of the film’s story, but includes motive, thoughts, and emotions. So, a story treatment will give the reader *aesthetic* and *emotive* impressions, which are useful for generating sound ideas. Directors’ treatments are also valuable documents for conceptualizing sound. They outline the director’s vision or visual plan for animating or shooting a project, how the director envisages the sound design, and what kind of music he or she intends to use. Some are purely written treatments, and some include visual

reference material such as illustrations and concept artwork. Alternatively, getting a sound designer to write an audio treatment is good way of gathering, exchanging, and clarifying sound ideas. An audio treatment functions in much the same way as a visual treatment, just from the perspective of sound. An audio treatment can also help a director gauge if a sound designer is on the same page and can serve as the start point for sound design and preliminary aural sketching.

### **SOUND IN SCRIPT**

The way a script is written has a greater impact on sound than is generally appreciated. Most people don't think in sound terms, and there's never been a clear or common tradition for conceptualizing sound. There's also a tendency to lean on dialogue and overlook how sound and sound-image arrangements can contribute to the storytelling. Some writer/directors, like the multi-award-winning Coen Brothers, are known for being specific about sound in their scripts. They also have a highly collaborative working relationship with sound designer Skip Lievsay and composer Carter Burwell. In *Barton Fink* (1991), sound is used to express Barton's strange and apprehensive arrival at a hotel in Los Angeles. Fink is a New York playwright who accepts an offer to write B-movie scripts in L.A. but is suffering from writer's block. His neighbour tries to help, and a bizarre sequence of events unfolds. The Coen Brothers conceptualized the hotel like an abandoned ghost ship, centering the audience on Barton's point of view, and using sound to support and advance the narrative. There's a surreal encounter in the hotel lobby, which is accentuated by an excessively long and unnatural bell ring. A mosquito whines. We hear the wallpaper peeling off the

wall. A picture of a woman on a beach coincides with the sound of surf and a gull. All these elements were written into the script, shot, and edited with sound in mind.



*Fig 4:3 Barton Fink (1991, dir. Joel Coen, Ethan Coen), Circle Films, Working Title Films*

In *Panic Room* (Fincher, 2002), a recently divorced woman and her daughter move into a new home in New York, which has a panic room. When three burglars break into their house, they take refuge in the panic room. The panic room is central to the film's narrative, so the atmosphere or ambience of the room was a key sound design element. The sound design was broken down into the "technical" (AC, electronics/TV monitors, lights) and the "emotive" (isolated, foreboding). One of the layers that made up the emotive dimensions was originally a choir, slowed down and filtered; another element was rain, treated with filters and delays (Prior, 2009). Through combining a number of different layers and textures, the panic room could be mixed and "controlled" to reflect what was happening with the characters (the emotive) and where they are in the room (the physical), and to support the action unfolding (the narrative). While sound may not be *written* into a script, thinking about sound when writing or reviewing a script will help in identifying key sound elements, ideas, or themes that have obvious or potential sound associations. By doing this, and considering the impact on the image, visual ideas will also surface, which helps inform cinematography, animation and editing.



*Fig 4:4 Panic Room (2002, dir. David Fincher), Columbia Pictures Corporation, Hofflund, Polone, Indelible Pictures*

Scripts are formatted in a standard way, and generally there is an accepted norm, although there are some variations between writers and the type of projects. Film scripts usually include a scene heading, action, character name, dialogue, parenthetical, transitions, shots, and other elements such as montages. Each element suggests aural information, which is useful for auralizing, and can serve as a vehicle for discussing and defining what could or should be heard and how that might impact, underpin, or inform the intended visuals.

### **Scene Heading**

The *scene heading* (or slugline) tells the reader where the scene takes place; it sets “the scene” in the reader’s mind. The scene heading describes where we are: indoors—interior (INT), or outdoors—exterior (EXT). Following the scene heading is the name of the location, BEDROOM, CAFE, CITY PARK, and then the time of day— NIGHT, DAY, EARLY MORNING. While not obvious, the time of day will influence sound. A CAFÉ at lunchtime will probably be busier (and therefore sound



busier) than it would be during late afternoon, and a CITY PARK will generally be quieter at night. Scenes take place in locations, which means scene headings suggest atmos, room tone, sound effects, Foley, and Walla.

An interior (INT) = room tone, room reverbs, sound and Foley effects, walla

A CAFÉ: small, large, quiet, or busy?

An exterior (EXT) = atmos, sound effects, walla

CITY PARK: distant traffic, birds, children playing?

### **Action**

The *action* (description) sets the scene and describes the setting and staging. Action is written in real time and helps the reader form an idea about the setting and the action that is taking place. We know where we are, characters are introduced, and events unfold. Some writers will also highlight key or important moments in capital letters, which includes sound moments or references. In the following scene from *WALL-E* (Stanton, 2008), the script tells us where the scene takes place (exterior of the truck), what time of day it is (night), the event (a sandstorm is approaching), and how WALL-E is reacting (unfazed). It references atmos (wind, sand) and how that plays out temporally, while also indicating perspective (the wind picks up, the sandstorm rages and approaches). Key sound and Foley effects are identified: a play button, warning light, WALL-E raising the door, WALL-E whistling, the door shutting, and the impact of the storm. The script also implies other sound and Foley effects: WALL-E's motor, WALL-E turning over the cooler, WALL-E heading back to the truck. We also know there is source music, which comes from WALL-E, which would be treated and mixed to sound like it is coming from him. We know the storm is intense, because it obliterates everything in view. We also know that sandstorms are common in WALL-E's world, because he is unfazed. If sandstorms were an unexpected event, he would be panicking:

### **EXT. TRUCK NIGHT**

Wall-e motors outside Turns over his Igloo cooler to clean it out. Pauses to take in the night sky. STARS struggle to be seen through the polluted haze. Wall-e presses the “Play” button on his chest. The newly sampled It Only Takes A Moment (IOTAM) plays. The wind picks up. A WARNING LIGHT sounds on Wall-e’s chest. He looks out into the night. A RAGING SANDSTORM approaches off the bay. . . Unfazed, Wall-e heads back in the truck. IOTAM still gently playing. . . The massive wave of sand roars closer. . . Wall-e raises the door. Pauses. WHISTLES for his cockroach to come inside. The door shuts just as the storm hits. Obliterates everything in view.

### **Character Name and Dialogue**

Before a character speaks, writers insert a *character name* to indicate the character’s dialogue follows. In the following scene from *Ratatouille* (Bird, 2007), the script tells us where we are (the French countryside), what time of day it is (late afternoon), the event (Remy is being “discovered”), and how Remy is reacting (frightened). It also makes a reference to atmos (rain, wind), room tone (kitchen), how the scene is shot (the camera tracks in from exterior to interior), and key sound effects (gunshot, furniture bumps, crash, window shattering, glass shards, and the “sounds of struggle”). We know there is the potential for silence (the action freezes) and that dialogue is a voice over (VO) from Remy. The writing defines character, his state, and a specific intent; Remy is scrawny, frightened, and comic, and the audience should feel sympathetic toward him.

FRENCH COUNTRYSIDE - LATE AFTERNOON A light rain falls on a SMALL FARMHOUSE. The last remaining dead leaves tremble in the gusts. The quiet is shattered by a LOUD GUN- SHOT that lights up the inside of the cottage. CAMERA pushes down and in toward a single window.

## RATATOUILLE

As we move closer, we begin to hear muffled SOUNDS OF STRUGGLE; furniture being bumped, dishes breaking, an indescribable CRASH, followed by an OLD LADY'S SHRIEK. We're close to the WINDOW now, when it is suddenly SHATTERED by a COOKBOOK. Instantly the action FREEZES. Underneath its splayed pages, shielding himself from the shards of splintering glass is, inexplicably, a RAT - REMY. He's scrawny, frightened, almost comic. It's hard not to feel sympathetic towards the little guy. REMY (V.O.) This is me. I think it's apparent I need to rethink my life a little bit. What's my problem? First of all—

### Parenthetical

A *parenthetical* remark can be an attitude, verbal direction, or action direction for the actor or character (or animator) and indicates a corresponding action and/or emotive style of delivering dialogue. Parentheticals are short, to the point, and descriptive. They help clarify an action or a reaction. For example, a character could shudder, be stunned, or be elated, which would all look and sound different. In films like *WALL-E*, where there is an absence of spoken dialogue, the intent can be written along with sound effects in a parenthetical or brackets. This indicates what the sound effects or “vocalizations” need to “say.” In the following scene, WALL-E is *inviting* EVE into his truck and then *panicking* as she starts unspooling his “Hello Dolly” tape.

INT. TRUCK - MOMENTS LATER The back door lowers. A rush of wind and sand. Wall-e pulls Eve inside. Closes the door. She coughs up dust. Wall-e hits a switch. . . Strings of CHRISTMAS LIGHTS fill the space. His racks of oddities painted in colored light. An air of enchantment. Eve is taken aback. Wall-e (beeps) [Come on

in.] She drifts through the sea of knickknacks. Becomes spooked by a SINGING BILLY BASS FISH. Threatens to shoot it, but Wall-e calms her down. He is compelled to show her everything. Hands her an eggbeater. . . . .bubble wrap (so infectious to pop). . . . .a lightbulb (lights when she holds it). . . . .the Rubik's Cube (she solves it immediately). .. .his Hello Dolly tape. Curious, she begins unspooling the tape. Wall-e (loud beeps) [My tape!!]

### **Transitions**

*Transitions* are used when they are integral to telling the story. A DISSOLVE TO indicates time has passed, a MATCH CUT illustrates that there is a correlation between something we just saw and something in the new scene, and a FADE OUT suggests transitioning to a new scene, time, or place. Visual transitions often accompany sound transitions; a MATCH CUT could result in transitioning between two sounds with similar sound properties, a DISSOLVE TO is like a CROSSFADE between two sounds, and a visual FADE OUT is much the same as an audio fade out (or fade down).

### **Shots**

A *shot* tells us the focal point within a scene has changed. Not many scriptwriters write shots into a script unless they are important to the story. Adding shots can interrupt the flow of a script and is generally seen as the territory of the director. For sound, defining shots gives a clear sense of the sound perspective. An EXTREME CLOSE-UP (ECU or XCU) often involves a close perspective, present and detailed sound association, whereas a WIDE SHOT (WS) suggests establishing sound, typically sound that establishes a location, such as atmos.

### **Abbreviations**

Some writers will use abbreviations in the action/ descriptive part of their scripts.

b.g. = background, which means action is taking place in the background

f.g. = foreground, which means action is taking place in the foreground

CGI = computer-generated image

SPFX = special effects (that do not require CGI)

SFX = sound effects POV = point of view

Detailing shot composition is comparable to detailing the positioning and mix of sound(s). Sounds in the foreground are generally louder (usually dialogue if there is dialogue and spot effects); sounds in the middle ground are quieter, but still present and often contextual; and sounds in the background may be audible but are often location orientated and/or functioning on a more subconscious level. Point of view (POV) shots are more subjective and therefore emotive; we're seeing/hearing the world from a character's POV, and SPFX and CGI generally dictate the need for specific sound and sound design effects.

### **Montages and Series of Shots**

"Montage" as a term is generally associated with the juxtaposition of images. Many film directors believe the montage is what distinguishes cinema from other mediums. In contemporary cinema, a montage is commonly understood as a series of shots or sequences designed to provoke emotional or intellectual responses. The connecting of images allows for complex ideas or emotions to be created and extracted by the audience. In other words, the editing of shots constitutes the intent of a sequence, as opposed to the content of an individual shot. In scripts, they are usually numbered or lettered 1, 2, 3 or A, B, C. A series of shots is similar to a montage, and written the same way, but it usually takes place in one location and concerns the same event or action. Montages are often conceived with and edited to music, but they can also be conceptualized creatively with sound and sound design effects. Film trailers are basically montage sequences accompanied by key dialogue and/or VO, music, and spot effects.

**Intercuts**

Intercuts concern the cutting back and forth between two or more scenes, which are often occurring at the same time. In scripts, instead of repeating the scene heading for each scene, an INTERCUT is used to tell the reader the scene is moving back and forth between locations. In the same way that montage sequences are often “held together” by sound and music, intercuts often follow the same formula.

**Superimpose, Title, and Credits**

SUPERIMPOSE or TITLE/TITLE OVER is used when text or an image is placed over footage, typically for information like the place or time. Text for sound is generally only relevant if it implies associated sound effects or design. For example, motion graphics and computer-generated text is often punctuated with sound effects in science fiction films. Film credits and text within trailers can also be approached creatively, which can determine the need for sound design.

**Emphasis**

As readers tend to skim-read a script, sometimes writers will emphasize words in capital letters, which draws the eye (and/or ear) to important or key elements, details, and actions that might otherwise be overlooked.

**Marking Up and SFX Lists**

Marking up a script is a simple and effective way of focusing on sound, and can serve as the basis for further discussions. Scripts are loaded with references to sound, and simply highlighting them can trigger ideas. An SFX list can also be created quite early in the process, which is helpful for considering each sound and how it could be sourced or created. Is it literal or not? Is it a sound effect or a sound design effect? An SFX list can be devised as a spreadsheet with columns for individual elements: room tone, atmos, Foley, sound effects, and sound design effects. Ideas for music or specific music cues can also be added. Some scripts don’t adhere to a traditional script format

and are written more like a story outline or a series of events. Regardless of the format, any text-based document can be “heard.” For example, a rough outline for *Steamboat Willy* might read as follows:

The film begins with Mickey **piloting** the Steamboat Willie **riverboat** down a **river** and **whistling** to the **tune** of “Steamboat Bill.” He **pulls a rope** to **sound** the boat’s **three whistles**. The tall and medium **whistle sound** off in sync but the shortest one stays **quiet** until it receives a good **hit** from the medium one. A **growling** Captain Peg Leg Pete appears behind him and **grabs** Mickey’s torso, **stretching** it in the process. Mickey **screeches** and retrieves his **innards**. Captain Peg Leg Pete **yells** at Mickey and Mickey **blows a raspberry**. Pete turns around angrily and **kicks** Mickey but **misses** and **hits** himself instead while Mickey **tumbles** down some **stairs**, **slips** on a bar of **soap**, and **lands in a bucket of water**. A parrot nearby by **mocks and laughs** at him, which provokes Mickey to **throw the bucket of water** on the parrot, who **squawks** for help. Pete, who has been watching this whole time, **pulls** out a **slab** of chewing tobacco, **sighs**, and **bites off** half of it. He **chews**, then **spits** in front of him, and the **spit circles** around and **hits the bell** behind him, causing it to **ring**. He **laughs** and attempts to **do it again**. He **spits** and **turns around** to watch it **hit the bell** but gets **hit in the face** instead. He **wipes** off the spit and **grumbles**. The film then cuts to a shot of a dock landing with two chickens **clucking**; a duck **quacks** and a cow **moos**. Steamboat Willie **makes its way around a bend**, and with **whistles tooting**, it **backs up** into the dock. Mickey is **lowered down to the dock** by a **crane** near the **cow**. He fastens a belt around the **cow**, which is **lifted up** to the ship. However, the belt is far too big and the cow far too skinny. Mickey attempts to bring the cow back down by **grabbing his tail** and

is **sprayed** by the udder. The cow is **lowered** back to the **dock** and Mickey, **squeaking**, attempts to **tighten the belt**. He **grunts** in frustration. He looks distraught until he sees a wagon of hay and grabs **a big fork load to feed to the cow**. The cow happily **swallows** the entire ball and easily **fills out** to the size of the belt and is **raised to the ship**. Just then, Minnie Mouse appears **running** to catch up to Steamboat Willie. Mickey **jumps aboard the ship** and takes off, leaving Minnie **yelling** at the dock. She **calls** out. Steamboat Willie **disembarks and toots**. Minnie Mouse, wailing, **jumps up and down**. She proceeds to **run** alongside the **river** after the **whistling** steamboat, calling for help. Mickey hears her and decides to **lower the crane** to catch her. The crane hook **lifts up her dress** and, grabbing hold of her bloomers, **transports her onto the ship**. As she is lowered, Minnie **drops her fiddle** and “Turkey in the Straw” **sheet music**, which bounces and **lands** by the goat. The goat sees it, makes an **appreciative utterance**, and begins to **eat the sheet music**. Minnie is **lowered to the ship** and the hook **pulls her dress back down**. Minnie is happy to see Mickey and turns shyly away to see the goat **eating her sheet music**. She **screeches** in alarm. The goat then starts on the fiddle and Mickey attempts to **yank it out of his mouth**. Mickey struggles but can’t pull it out and falls on the ground, launching the fiddle into the goat, which proceeds to **bounce around, causing music notes to sound**. Mickey hears this and gets the idea to use the goat as a phonograph. He opens the goat’s mouth and calls Minnie over. Minnie gets the idea and begins to **“crank”** the goat’s tail and **“Turkey in the Straw” begins to play**. Mickey then starts to join in and play along with the tune. He uses a **barrel** and **garbage can** as drums, **bangs on pots and pans**, **strokes a washboard**, **pulls on a cat’s tail to make it sing** and swings it around his head, uses a **duck as a makeshift bagpipe**, **pulls on piglets’ tails to make squeaks**, and finally uses the



**cow's teeth as a makeshift xylophone.** After the song, Mickey takes a bow and finds Peg Leg Pete scowling at him. Pete **growls menacingly**. Mickey **sighs** and attempts to walk away, but Pete **grabs** him and **dumps him** below deck to **peel** potatoes. Mickey **sighs** again and **grabs a potato**. He grabs a large knife and starts **cutting the potato** and **throws it in a bucket**. The annoying parrot flies through the window and begins to **mock and laugh** at him again, provoking Mickey to **throw a potato at him**, sending the **squawking** parrot **splashing** into the water. Triumphant, Mickey begins to **laugh** and the film concludes.

### **Script Breakdowns**

After a script has gone through revisions and a final draft is locked, the script is broken down. In film and television, a script breakdown is defined as (1) an analysis in which all of the production elements are reduced to lists in order to schedule and budget the production and (2) the director's creative analysis of the dramatic action and design elements. The process is repeated for each scene and information is compiled into a table with columns listing the scene number, location, atmosphere, characters, backgrounds, props, VFX, dialogue, SFX, music, production notes, and comments. This helps in the creation of dialogue recording scripts, SFX, and music cue lists, which further defines ideas raised during development. The process of breaking down the script usually occurs after the producer and director review the script and mark certain elements that need to be taken care of before production, or even before preproduction can begin.

## **AUDIOVISUAL DEVELOPMENT**

### **Concept art**

Concept art explores, conceptualizes, and articulates the visual elements of a film. While sound has no formal equivalent, concept art can serve as a means for exploring

the look, feel, and sound of a film. Aural sketches can be created from viewing visual sketches, mood boards, visual treatments, illustrations, and photographs. While static images are rarely associated with sound, they do offer aural information. Images can provide acoustical information about environments and physical information about props. In animation, if the intention is for authentic and real-sounding environments, then real rooms and locations with the same or similar acoustic properties can be sourced and recorded. Depending on the level of detail, concept art can translate into sound ideas and serve as a starting point for sourcing and creating sound and sound design effects:

- Casting and character design = dialogue, sound, and Foley effects
- Props = Foley and sound effects
- Backgrounds and environments = atmos, sound effects, sound design effects, walla
- Rooms and interiors = room tone, sound design effects

Aural sketches can also be used to communicate ideas in reverse. On the short film *Lifted* (Rydstrom, 2006), writer, director, and sound designer Gary Rydstrom created a temporary soundtrack before animation, as a way of articulating what he wanted to the animators. In the film, an overly confident young alien (Stu) is taking an examination in alien abduction inside a spaceship. Confronted with a large console with a large number of identical switches (much like a sound mixing console), he must abduct a sleeping farmer from his bed with the ship's tractor beam. Every time he selects the wrong switch, he causes the sleeping farmer to bump into the walls and ceiling. He finally succeeds in manoeuvring the farmer out of a window and up into the ship, but then he shuts off the tractor beam without closing the cargo hatch, and the farmer plunges toward the ground. The examiner (Mr. B) takes over the controls and puts the farmer back in his bed. Upset at his failed examination, Stu struggles to hold back tears, causing the now sympathetic Mr. B to let him resume control of the spaceship. Stu grabs the controls and accidentally slams the ship into the ground,

crushing the farmer's house. When it lifts off, all that remains is the crater and pillar of dirt, with the farmer still asleep on top. As the end credits run, the sound of an alarm clock is heard, followed by a yawn, a scream, and a thud, indicating the farmer has fallen "out of bed" and into the crater. When watching/listening to the opening scene, you see/hear how a temporary soundtrack or aural sketch can help inform the rhythm, timing, pacing, and design of a scene, sequence, or entire short film. *Lifted* is science fiction and comedy, and in comedy films "comic timing" is especially important. The use of rhythm, tempo, and "beats" (pauses) enhances the humor and allows the audience time to recognize and respond to jokes and gags. The film opens with a *tranquil night atmos*, followed by the arrival of the space-ship, which is indicated by *rising wind* and a *rumble* causing a wooden swing chair and a weather vane to *creak*. It cuts to an interior of the house, where the sleeping farmer *snores*. A flash of light from the ship's tractor beam lights the room, which is punctuated with music and an *electronic sound design effect*, both of which intensify as the farmer is elevated out of bed and transported toward a window. The music and sound effect cuts out as he *hits* his head on the side of the window and *snores*. The beam attempts to transport him through the window but misses again, and again the farmer *hits* his head and *snores*. We then cut to the *interior of the spaceship* and Stu attempting to *flick* the right switch. A *hologram* of the house and position of the farmer *alerts* him that he has failed. With a *click* of a pen, Mr. B starts *writing*, noting Stu's failure.

## Storyboards

While scripts serve as a starting point for production, many directors rely more heavily on storyboards to communicate their vision for a film, especially complex scenes. A film script is a text-based document and is often dominated by dialogue, whereas film is audiovisual "text," so reimagining a script in visual form makes sense for the medium. Martin Scorsese uses storyboards to visualize and plan entire films. Some of the scenes in Alfred Hitchcock's films were so complicated that storyboarding became the most appropriate way to communicate them to others.

Storyboards are visual breakdowns of the script and indicate how a film will be seen through the perspective of a camera lens. They allow production teams to see what certain shots will look like before shooting or animating them. Storyboards describe framing, camera shot sizes (close-up, medium, wide), and camera movement, so are valuable tools for identifying audio requirements, problem solving, and exploring aesthetic possibilities. As animation is an expensive and time-consuming process, creating shots or scenes that could eventually be edited out of the completed film is impractical. Storyboarding isn't limited to animation. For *Mad Max: Fury Road* (Miller, 2015), George Miller devised the film as storyboards before writing the script. Ridley Scott (*Bladerunner*, *Aliens*, *Gladiator*, *The Martian*) is another director known for storyboarding entire films. Storyboards are a cost-effective way of aural-visualizing a project, through adding sound, given the relative ease of creating moving storyboards or story reels.

### **Shot Lists**

A shot list is created after storyboarding and is a document that lists and describes the shots to be filmed during principal photography for a live-action film. It takes into account characters in the shot, type of shot, camera movement, action, and any important props. The main purpose of the shot list is to make sure that every part of the script is assigned a shot. Once completed, a shooting schedule is created, which takes into consideration locations, budget, time restrictions, weather, complexity of shots, pickups, on-set logistics, and actors' availability to create a schedule. In animation, shot lists are also used to determine the complexity of shots by taking into account how many characters are involved, props, backgrounds, and camera movement. In both situations, they can also be used to plan for production sound and further isolate ideas for sound.

**Story Reels**

Once a storyboard is completed, shots and scenes are timed to make sure the correct or proposed duration is maintained. The most effective way to do this is to create a story reel (or animatic), which consists of images from the storyboard synchronized with a soundtrack. An animatic is essentially an animated storyboard. The term is used in both film and animation, although more commonly in animation production. Storyboards, or panels are brought into a picture editing program and cut together. Today, editing software packages make it easy to time panels, add motion and camera moves, integrate sound, and export reels. Story reels help inform the picture edit and can reduce expensive postproduction time, which extends to sound design and audio postproduction. The integration of sound assists in timing and pacing, developing or clarifying the narrative, and identifying aesthetic opportunities.

**Pre-Auralvis**

Pre-visualization processes are becoming common in the film and digital media industries. The concept is optimization of preproduction before production begins, particularly for complex live-action scenes. Increasingly, 3D animation and virtual environments are created to block shots and camera movement, which helps establish the look of a film. This allows the director to conceptualize and test complicated scenes before production. The same information can also be used to establish the sound of film. The concept of pre-auralvis is the consideration and incorporation of sound design in early stages of development. Pre-visualization, like the creation of story reels, takes a script into an audiovisual medium. Throughout early development processes, there are pivotal “points” where hearing sound with pictures helps inform the story, the edit, and the mix. As securing funding is highly competitive, polished pitch materials can give a project an edge. Film-funding bodies are increasingly expecting more extensive pitch materials. Dedicated companies have emerged that specialize in creating pitch and pre-vis material to communicate ideas to potential

investors. On *Gravity*, sound designer Glenn Freemantle sound designed a forty-five-minute pre-visualization for studio executives.

Animation studios such as Pixar and DreamWorks use “iterative/agile design” models, which incorporate editorial into pre-vis and production phases. Integrating an inclusive audiovisual editorial phase affords sound the opportunity to “update” the soundtrack against and visual changes and new edits. In turn, the director has the opportunity to evaluate how sound and image are working together. Active collaboration also helps illuminate anything that’s been misinterpreted or overlooked within the story development stage. In live action, the same principle can apply, starting with concept art, storyboards, reels, or pre-vis for development of sound design, and continuing throughout the picture edit phase for finalizing sound and music prior to the final mix.

### **Scratch Tracks**

The use of “scratch tracks” (or temp tracks) is common in animation production and refers to a preliminary dialogue track, or vocal songs in the case of musicals, so that the animation can be timed, which usually starts at the story reel stage. Using dialogue, temporary music, and sound effects is a more precise way of synchronizing animation to a soundtrack. It’s generally easier to synchronize animation to a preexisting soundtrack than it is to synchronize a soundtrack to preexisting animation. Some directors also prefer recording dialogue before storyboarding, which is useful for artists to storyboard with. A cost-effective scenario is doing a “scratch recording” of dialogue using in-house personnel. The performance may not be professional or “right,” but it will give the director ideas in terms of timings and performance direction. The process also helps to work out how long recording sessions are likely to take, which makes scheduling and budgeting voice recording sessions and dialogue editing easier.

The degree to which sound is able to participate in storytelling is largely determined by the use of time, space, and point of view, which means scratch tracks can be used to help clarify, define, and lock shots. Once visuals are complete, some sound elements may no longer be necessary and/or need to be revised, but having “place holder” sound makes it easier to get a sense of how a scene is working or not. Without hearing sound, it’s fairly common to overlook how sound affects image and vice versa. A shot could be depicted as a wide shot (WS), but the script and story may call for a particular sound effect that dictates a tighter shot. Sound is temporal, and certain sound elements, such as atmos and sound design effects, need time to “work.” If a scene calls for rain to start and get heavier, the scene may need to be timed for that to happen. Rain generally starts slowly, with a few spots, and then builds and gets heavier. As sound design effects often function psychologically and subconsciously, audiences need time to engage with the intent. In addition, a storyboard or reel may not contain VFX information, and it’s very easy to miss subtle details and opportunities for sound when not seeing everything that’s going to be in a shot. A montage scene may have been devised with music in mind; while this might be the best direction for the sequence, it might work even better with spot sound effects and music. Once you start hearing sound with pictures, you’re in a better position to assess how the final scene will feel.

### **Temp Music**

A temp music track is an already existing piece of music that serves as a guideline, or a means of communicating a certain mood or style, emotion, pace, rhythm, progression, and instrumentation for a project. Music can come from a variety of sources, from production music libraries, film soundtracks, and CD’s/albums. Without a temp track or some form of reference, composers can be left guessing as to what a director wants from the music. Temp tracks are a starting point and should only be used during preproduction. A specially hired composer will later replace the track with original music. Temp tracks can save time and money by avoiding the composing of countless tracks, because the composer has gone down a completely different path

from what the director envisioned. Music can be difficult to articulate, and temp tracks can help bring a film to life while conveying the music's desired effect more efficiently than a brief, especially if the director has no musical experience.

There are a number of pitfalls when using temp tracks, and the way they are used needs to be defined before any work is undertaken. If a composer is asked to create something similar to another composer's work, there is the risk of plagiarism. Composers often feel creatively limited by having to follow a temp track, especially scores by well-known composers. If a composer is directed to adhere to the temp track, his or her creative input will also be stifled. A composer could have completely different ideas, which might be better than the temp track. A director might also select a number of tracks, or sections from many different temp tracks, and inadvertently confuse the musical direction. The use of temp tracks throughout production can also result in the rejection of original music because the temp track is heard so often anything new feels wrong or not as good. The "attachment problem" also occurs with sound effects and design; if a director has used stock effects, an attachment to them can form. Temp tracks are useful for communicating ideas and guiding a story reel or rough edit, but they should be removed as soon as possible. The alternative, and a better route, is hiring a composer early and working alongside him or her to create completely original music.

### **Research and Referencing**

As it's difficult to articulate sound and musical ideas, using other forms of media as reference material can be helpful as a communication tool. Alongside preproduction documentation, music, archival footage and sound, illustrations, photographs, and books often function as audio research and reference tools, particularly in the case of period and historical films. To create the sound design for *Master and Commander: The Far Side of the World* (Weir, 2003), sound designer Richard King and director Peter Weir reviewed Patrick O'Brian's novels for inspiration. The film is based on



O'Brian's books, specifically about naval life during the Napoleonic era, and Weir wanted both the visual and sound design to be as authentic to the period as possible. Most film projects will involve some form of audio-based research, whether it's for the purpose of creating authentic and localized soundtracks or merely reviewing and considering other materials for inspiration. *Mad Max: Fury Road's* (Miller, 2015) sound designer Mark Mangini was inspired by *Moby Dick*, drawing a parallel between the truck and Moby Dick (Hutchinson, 2016). The truck was "personified" as a giant, growling, breathing, roaring beast through combining truck sounds with whale sounds. At the end of the film, the truck is being fired at by harpoons, which adds to the metaphor. There's the sound of metal and deep, whale-like groans. Films are also often adapted from novels. *Coraline* (Selick, 2009), for example, was based on a Neil Gaiman novella with the same title. While there are obvious differences between film versions of novels, reading a novel introduces the story, characters, and general themes in a different way from reading a script, which can elicit ideas. *Coraline* the novella is described as a horror/fantasy tale of a young girl who finds a portal into an alternate reality. Even a simple description of the genre and brief synopsis lends itself to sound ideas, specifically the real versus the alternate reality, which is fundamental to the narrative. Sound designers Ron Eng and Steve Tushar split their roles in a similar way; one role involved creating the real-world sound effects such as impacts, doors, hits, bangs, and squeaks, while in contrast the other role was focused on creating the otherworldly sounds for the alternative world, such as a haunting mirror squeak.



*Fig 4:5 Coraline (2009, dir. Henry Selick), Focus Features, Laika Entertainment, Pandemonium*

### **Design Direction**

Depending on the degree of preproduction undertaken, the first step in audio production is further assessing soundtrack requirements. Materials generated throughout preproduction assist with identifying audio direction, while visual information created during production further defines soundtrack design. Dialogue and other vocal material such as walla need to be recorded or rerecorded; sound, Foley, and sound design effects need to be sourced, recorded, or generated; and music needs to be sourced, licensed, or composed. The start point for sound design is the collecting of raw sounds. Sound Designers source and record anything that could prove useful for creating sounds. Films often have specific or key environments and elements that are unique to the film, like the helicopters in *Apocalypse Now* (Vietnam War), or the truck in *Mad Max* (postapocalyptic Australia). Dialogue, music, and certain sound effects are often specified within a script, whereas nonliteral and

psychological sound is implied, which entails experimentation. The process of recording, generating, and editing sound is when emotional responses to sound are identified. Even the “simplest” of sounds evoke emotion; doors can creak in numerous ways, from annoyingly to spookily. However, it’s not until you start hearing sound with pictures that you can really gauge the effect.

Something magical happens when a sound effect is added to picture—and it’s not predictable. After all my years of doing it, I still depend on experimenting, putting sounds against image and seeing what happens. First time I did this, as a film student, it amazed me how sound could “open up” a movie, how the combination of sound and visual could create something greater than the sum parts. Having a great sound library is essential, but the real secret is how one uses it. (Rydstrom in Milani & Placidi, 2011, para. 16)

Digital recording and manipulation has enabled the potential for greater complexity in sound design; however, attaching sound to every visual event can be problematic. Too much sound can “crush” the visuals and result in narrative incoherence, which can de-emotionalize a film. On *Coraline* (2009), director Henry Selick avoided complex background sound in certain scenes, so the audience was presented with only what they needed to hear. In the film, Coraline and her parents move to an old house. Her parents are so tied up with their work that she feels neglected. While exploring the house, she finds a hidden door to a parallel world with seemingly more caring parents who spoil her. Her “other mother” invites her to stay, but she refuses after discovering that the alternate reality is a trap. The house is wooden, with many floors, so it could “authentically” have creaked and groaned in the way that old wooden houses do, which would have made the house creepier. Instead, the house is quiet, which accentuates Coraline’s feeling of alienation. The audience hears sound associated with or caused by Coraline, but not the house itself. As the film unfolds, the “other mother’s” evil side is exposed and the story takes on a darker tone, visually

and sonically. If the house was dark and creepy and creaky from the onset, the impact of Coraline's discoveries and the change in tone would be diminished; the dynamics of the soundtrack and the impact on the narrative would be different.

A film like *Bolt* (Howard & Williams, 2008) has a more dense, and multi-layered soundtrack. The plot centres on a dog named Bolt, who, having spent his entire life unknowingly isolated in a TV studio, believes that the fictional world of the TV series he plays a lead role in is real. When his co-star and owner Penny is "kidnapped," Bolt escapes from the studio to rescue her. After Bolt escapes from the studio, he accidentally ends up in New York and must make his way across the country, back to Los Angeles. In the fictional TV series, Bolt possesses superpowers, but once he enters the real world, he becomes an ordinary dog. His "real world" journey is set in real-world locations, so the fictitious television world and the "real" world environments have different visual and sonic aesthetics. The TV action show is "shot" and sounds like a Hollywood action series, a story within a story, which contrasts with Bolt's "real" journey, which looks and sounds more naturalistic. *Blue Velvet* (Lynch, 1986), is described as psychological horror meets film noir, and operates on a number of thematic levels. Alan Splet divided the film into two distinct worlds of sound: the bright, ordinary world inhabited by Jeffrey, a college student, and the dark and twisted underworld inhabited by the psychopathic Frank.

Aside from production sound, there are few differences between live action and animation for sound design, except the relative ease of integrating sound earlier in animation. Contemporary animated films hardly ever adopt the classic "cartoon" (*boing, kapow, ziiiip*) approach to sound. The goal is usually "realism," but it is frequently a different kind of realism from that in most live-action films. In animation, sound can be more easily exaggerated. We know animation isn't "real." Live-action films are trickier; realism needs to feel very real, but as most films are sound designed in postproduction, it's still a fabricated reality. The lines between animation and live

action are diminishing. *Lord of the Rings* (Jackson, 2001) is set in Middle Earth, which is based on Earth, but with a number of mythical elements and creatures. *Avatar* (Cameron, 2009) was predominantly CG animation and VFX; Pandora and the Na'vi are fictional. Regardless of production format or style, through considering how something should or could sound, various directions will naturally come under discussion.

### **Creative Collaboration**

Sound designer Peter Miller went to film school in the late 1970s and specialized in sound. After a period of working in television, he formed production company Meaningful Eye Contact with director Alex Provas, producing music videos, commercials, and films. He later set up a music and sound design company, Perpetual Ocean, and recently Scribbletronics to focus more on self-generated audiovisual projects. His earlier friendship with film editor Craig Wood, and Gore Verbinski's interest in creating a creative "trio" (director, editor, sound), led to Miller working with Wood and Verbinski on *The Ring* (2002) and later *Rango* (2011). *The Ring* is a supernatural psychological horror film and a remake of the 1998 Japanese horror film of the same title, based on the novel by Koji Suzuki. The film centres around a strange and haunting videotape; after viewing it, the viewer dies seven days later. The videotape plays a montage of disturbing images, with sound design, which serves as the clues to its origins. A journalist decides to investigate following the unexplained death of her niece. She acquires the tape and after viewing it, finds herself with only seven days to prevent her own death, as well as that of her son and ex-partner. Horror as a genre lends itself to sound design, but it needs to feel real, and scary. Watch a horror film without sound, and generally it's not very frightening.



Fig 4:6 *The Ring* (2002, dir. Gore Verbinski), DreamWorks, Parkes+

Doing *The Ring* was fantastic because Gore was so receptive to the kinds of ideas Craig and I were putting together, and we had a lot of contribution to the whole soundtrack, including the direction of music, the selection of temporary tracks, which made Hans Zimmer interested in the project. There comes a point, and certainly in *The Ring*, where we were very much in intellectual land. You're not scared by it anymore, so you have to make decisions about what you're doing—will it scare the audience? You can never tell how an audience is going to react to something.

In *The Ring*, there were times when we were not sure whether something was scary or not, and it's very hard to make an assessment. There's a sequence where the Mother of the girl pushes her down the well. At one stage I suggested to Gore that the scene might be much more powerful if we did it without any sound. Initially he was skeptical

and then we tried it and he was amazed. We put it to test screening and it just freaked the audience out, so in the end we had to pull back because it was too strong. It also made the Mother, who was callous enough pushing her down the well, seem harder—it just made the whole scene so black.

Certain things don't translate well to test screenings, especially for sound, if it doesn't have some of the things in it you're intending to do. A good example of that was when the horse gets spooked and jumps off the side of the boat. It went to a test screening and was fine, and then we had another test screening about a week and a half later, and people were freaked out by it. We couldn't understand why there was such a big difference considering the first audience made no comment about it. There were questions about the horse, was it a real horse, but no, it's a digital horse. The difference was, we put a sound effect in for when the horse falls and hits the side of the boat on the way down, and that's what was doing it. Suddenly it felt real, and we decided that was a good thing. (Miller, 2016)

Mystery/thriller *In the Cut* (Campion, 2003) tells the story of Frannie Avery, a New York City high school teacher who has an affair with a local detective, even though she suspects him of murdering a woman. As the relationship develops, she discovers more and more evidence pointing to him being a serial killer. After her half-sister is murdered, Frannie fears she might be his next victim.



*Fig 4:7 In the Cut (2003, dir. Jane Campion), Pathe Productions, Pathé Pictures International / Red Turtle*

One of the things we noticed straight away was that it was a psychological story, which led to the possibility of internal sound, sound that directly taps into your emotions, not literal sound which taps into a location. We realized the story was easily dividable into a vertical structure. The character spent some time downstairs; there's several scenes in the subway and a basement bar. The writer had written them in such a way that they represented the subconscious, her subconscious. Then there's the street level, the realistic element. She's on the street, talking to people, and it's all very real. Then there's upstairs, which represented her safe places. Her apartment was upstairs, and her friend's apartment was upstairs. Each of those scenes plays out with her feeling like she's secure. Straight away we had a perfect sound structure. So, it's sitting with the script and realizing there's a sonic environment there, it's a literal environment, and it's a psychological environment. We decided when she's downstairs, when



she's underground, we'd lose all the high frequencies material, so there's lots of rumble and it's quite muffled, like the music from the club upstairs. Everything downstairs we take away the definition of reality. In the middle, we're in reality, so everything is hyper-real, we're using all the sounds of traffic, and more high frequencies, and when she's upstairs we go into a place of comfort, so we take away all the bottom frequencies, we let it feel like it's light, add some air in there. You don't notice it when you watch the film, but it really affects the way you relate to the story and her character. It's a very important way to be able to see films. It's the great thing about sound; it transmits right across reality, through the psychological to the emotional. Sound is really powerful like that. It's a direct conduit into someone's emotion. We can go in, push that emotion button right inside their brain, and they don't even know we're doing it. You can sneak up behind someone and tap them on the shoulder, which visuals can't do. Some sound works psychologically on an audience; it's nothing to do with its literality.

If I was a writer and I didn't have any sound knowledge I'd go to a sound person and say I'm going to write this script about this story, give me some thoughts. Sound people always have thoughts about things. Say it's a story about vampires and set in New Orleans—a sound person will say, you know there's swamps, there's alligators, so immediately you're getting a sound picture, and that's what you need as a writer, you need that sound picture put in your head. You might know that as a writer, that there's swamps there, but as soon as somebody says, think about the frogs, think about all the sound that's going on in a place like that, and then think about what you can do by taking it all away and having silence. Straight away you're seeing the

drama of the sound develop, suddenly there's a dramatic landscape in your sound. As you start to type and think, in this scene we could have no sound, all the sound of the swamp could disappear. That's going to inform how you set that scene up, and what you do with it. For me it would be great if when a writer sits down to write a script they go, okay, here's my story, these are the locations, and here is the sound I imagine. It's about finding the sound inside the story. Every story is set somewhere, and every place has its own sound environment, and it doesn't have to be a literal environment; it can be an internal environment. (Miller, 2016)

In devising the Academy Award-winning *Rango* (2011), Verbinski and a number of artists spent more than a year creating the film as sketches with a dialogue track. Verbinski then pitched the project to Paramount and Industrial Light & Magic. He later filmed scenes of recording sessions with the actors, which were cut together and used as reference by ILM. Due to his background as a live-action director, he wanted what was later termed “emotion capture”—the actors performing together as they would in a live-action film to capture the live-ness of their vocal performances. The filmed material also became useful for the referencing of the characters' reactions and interactions, which is not usually captured during typical voice recording sessions. Verbinski wanted emotional realism rather than photorealism, and for the animation to be “ultra/super realistic,” which entailed thinking about it as a “movie,” as opposed to an “animated movie.”

Rango is a lonely pet chameleon living in a terrarium, which accidentally falls off the back of a car, leaving him stranded in the middle of the Mojave Desert. After an exchange with a philosophical armadillo, he sets off to find water and himself. Surviving an attack from a malicious hawk, he meets a female chameleon named Beans. She drops him on the outskirts of a town called Dirt, where he ends up in a bar

pretending he's a dangerous gunslinger from way out West. Another attack from the hawk results in Rango accidentally killing the bird. In the process, he becomes the sheriff of Dirt, which is presided over by an old tortoise who controls the thirsty town's water supply. Rango starts to suspect the mayor is behind the water shortage, but before he can do anything, the mayor's henchman, Rattlesnake Jake, exposes him as a fraud and Rango is cast out of the town. He walks back to the road, encountering the "Spirit of the West," who convinces him to return to save the townspeople.



*Fig 4:8 Rango (2011, dir. Gore Verbinski), Paramount Pictures, Nickelodeon Movies, Blind Wink Productions*

In discussing his sound design work on *Rango*, Miller details the collaborative nature of the process, starting with storyboards:

I first got an email from Gore, and he said I'm doing this Western. It's kind of like a combination of Sergio Leone, Carlos Castaneda, and Miyazaki, and that's what *Rango* turned out to be. *Rango* was great; it's the best thing I've ever done. The whole experience was fantastic—the working experience was great and the movie is great. It's the most

unaffected movie I've ever worked on. What you see on the screen is Gore's total vision. He was able to do what he wanted on the film, and we were able to do what we wanted on that film. It's the purest Hollywood film I've ever been involved with. He had some good producers, he also had contacts in ILM, and they hadn't done a full feature animation, and particularly the kind of animation Gore had in mind, super realistic, so they were very keen to do it. He had all the right things at the right time. It was storyboarded from the first frame to the end frame, immaculately, so the studio knew exactly what kind of movie they were going to get.

I worked on *Rango* for two years, starting when the storyboard edit was almost complete. The first thing they did after they had a working storyboard was to photograph the storyboard. They photographed every single frame of the storyboard, put it into FCP and then they started animating it in a very basic way. So, you'd have a shot of Rango and they would animate a head move, just two frames, to give it some feeling of movement. Occasionally they would have Rango move across a frame. It was very basic, pencil drawings, the whole film moving like that. That's when I came onto the movie and started putting sounds in. We started building a soundtrack in full surround soundtrack, laying sound up, and working out ideas and all kinds of things. I was still in Australia at that time, but Craig was cutting, and he would send me little snippets and say, "Can we do something here, for that?" He'd then lay that back into the edit as he progressed. So, we literally built up a working model of the film. It ran 100 minutes, which was the contractual length of the film. It had every single frame that was going to be in the film. When they started doing animation, they were literally popping that out and popping in the wireframes, and then

they'd pop that out and pop in the first renders. As we went, the sound would get refined because things were moving, so suddenly it would be different.

I also went across to Universal and did a whole lot of temp things for the big musical numbers. There was no composer at that stage, but Gore wanted some structure. There's a scene, which we call "metaphor," which is where Rango meets the Armadillo character, and he tells him about the road—it's a metaphor. Rango goes through this process being thrown from car to car and under the truck, so I built up a rhythmic piece. Later there's a scene where the villagers are doing a weird water dance so I did something for that. None of it ended up in the movie, but the animators were told to animate to that piece so by the time Hans came on he had a fairly tightly structured rhythmic scene he could work to. We built the sound alongside everything else and a lot came out of that. Gore has great ideas for working with teams of people. We were all in the Universal lot, in a big two-story building with a theater, offices, and a whole floor, which were the cutting and sound rooms. So, we set up all together, I had a sound room, and there were production people, the animators, people doing pre-vis, and the cutting rooms. So, we were all together. Gore would literally walk around the rooms and sit in and listen to what we were doing, or he'd be in the cutting room. It was fantastic, because all the time you're seeing what everyone else is doing. It was unparalleled, a really fantastic way of working. I was also working with sound designer Tim Neilson, a really good sound designer. There's a sequence when Rango walks across the road after he gets thrown out of the town—we called it "the suicide walk." He did beautiful work there, which stayed all the way through the movie, so ended up on the

screen at the end because it was so perfect. It's beautiful and ghostly; the cars are not heavy, just swishes. It was lovely.

There were many cases where we would put in sound and it would inform what was going on in the story. Early on we put a wind sequence in and Gore really liked it and said we should leave space for that because it really helps. It's when Rango finds himself in the desert, where he's talking to the Armadillo character, from there all the way through until he gets to Dirt. Aside from the chase sequence, it slowed it down from what it would've been. After his terrarium falls out and he's standing there, there's a slow development; he walks across to where the fish is and looks up at the sun—there's lots of space in there. The storyboard was a still so it could be extended longer, which made it feel better, to feel the tempo along with the sound. If you're cutting a film mute and not spending time with sound, you tend to tighten everything up because you think, it's boring now, so let's get out of that scene really quickly. Your brain, quite rightly, doesn't have any information coming in so it wants to go on to the next thing. If you give it some sound, there's some space, and your brain has got something to work with. (Miller, 2016)

### **Project Planning**

Projects need to be evaluated (and often re-evaluated) in order to prepare and maintain a realistic production plan. Creative opportunities, complexities, and potential issues need to be discussed by key people involved. At least 50 percent of a film is audio, and many argue that good sound is at least, if not more important than the visuals. Given today's technology, it's easier to get your film to look good than in the past, but bad sound is still the tell-tale sign of a low-budget film. Films with poor sound rarely get selected for film festivals or distribution. This makes it especially important to focus on getting

good production sound and preparing for post-production. One of the first steps is hiring a sound designer or supervising sound editor; someone capable of ascertaining requirements and working alongside the producer, director, and postproduction supervisor. The planning stage also involves establishing roles, responsibilities and relationships, budgets and schedules.

### **Budgets and Scheduling**

Hollywood feature film sound budgets are approximately 3 to 5 percent of the total production budget. Medium-sized film budgets have decreased, and on the other side of the spectrum, independent production budgets can range from a few thousand to a few million dollars in total. A number of film directors have migrated to working in television, with budgets similar to those of medium-sized and independent films. Shorts, micro and Web-based films are a way for film-makers to cut their teeth, often on very limited budgets, so allocating 3 to 5 percent of a total budget for sound is usually inadequate. A sound designer/supervising sound editor will be able to review materials and devise a more realistic budget, relative to available resources. Typically, a location sound mixer will hire a boom operator and utility person, or in the case of very low budgets will handle all three jobs. The location sound team captures the dialogue, room tone, and atmos. Preparation and attention to detail ensures quality production sound, which will reduce postproduction costs. In the United States, basic budget requirements for a location sound mixer are approximately \$300 to \$500 per day and \$150 to \$250 per day for a boom operator/utility person. Sound studios generally have “rate cards” and charge either by the hour, day, or week, depending on the type of service they offer. Some studios will offer a variety of services, whereas some may specialize in a particular area, such as ADR. Media and entertainment organizations and unions provide local salary rates, which, depending on the specific role, type, and scale of the project, are normally per hour, day, or week. In the United States, rates for sound editors, designers, rerecording mixers, Foley artists, and

other associated roles can be found on the Motion Picture Editors Guild website. Depending on the project scale, fees can range from \$2,000 to \$4,000 per day for talent. Music is always a separate budget. Musician rates are normally by the hour or number of lines in a score, conductors by the session, and composers by the minute, episode, or project. A current trend in composing is toward the “self-contained” composer, predominantly MIDI-based compositions, especially for low and medium-budget projects.

An audio postproduction budget covers sound supervision, dialogue/ADR, sound effects design and editorial, Foley, re-recording mix, and deliverables. Sound supervision includes previewing, fixes, and client correspondence. Each stage of production should be broken down and budgeted for and the appropriate facilities scheduled and booked. As with visual elements, when working with small budgets and short production schedules, expectations need to be managed. If the budget is too low, it may be inadequate for hiring Foley artists, commissioning a composer, using music tracks from an established artist, or under- going a Dolby-certified surround sound mix. One of the first things to establish is the final output. Is it for the Web, broadcast, DVD, or theatrical release? Most low-budget independent features and short films have limited budgets so may only be able to afford a stereo mix, whereas medium and higher film budgets include a 5.1, 7.1, or Dolby Atmos- mix. Sometimes studios have “down time,” so if a project is flexible, it’s possible to get reduced rates in between bigger commercial projects. It can be difficult to schedule and budget for sound design. Estimating how long rerecording dialogue will take or the cost of licensing a music track is easier to ascertain. Certain requirements might be clear, but time for recording and experimentation needs to be built into schedules. It also varies with workflow and the size of the sound department. Each project needs to be evaluated based on the length, scope, and overall budget. Obviously, a one-minute short animation for the Internet will not require as much time as a full-length action feature film. As a guide- line,



sound should at the very least approximate picture editorial and post schedules; for example, six weeks of picture editorial equal six weeks of sound editorial, and two weeks of picture finish equal two weeks of mixing (re-recording). Also, if the production sound is poor, the postproduction schedule and budget will increase. As animation dialogue is usually recorded in studios, therefore controlled, a basic rule is to allocate eight to twelve hours per minute of animation for sound design, but if a scene involves a lot of action and visual effects, then usually both sound design and mixing will take longer.

Once the project and delivery date have been defined, the script broken down, and budgets allocated, the overall schedule can be created. An ever-increasing number of tools and apps are being developed for creating and managing breakdowns, shot lists, storyboards, schedules, and associated production information so it can be easily shared, revised, and updated as production unfolds. As with other areas of production, the sound schedule needs to be realistic. Scheduling is always difficult and dependent on a number of factors: the type of project; delivery dates for picture edits, animation, and VFX; and the final deadline. Scheduling will also affect the budget; if the project has a tight deadline, a bigger sound team will be needed to meet any deadlines. Other issues are availability of talent, facilities, music clearance issues, and any test screenings. Schedules will also change if there are rendering or picture issues that need to be addressed, which may require rescheduling talent and facilities.

As technology has evolved and become more affordable, it is possible to design a soundtrack without needing a full-scale commercial studio facility, especially for short films, Web-based projects, mobile games, and other smaller-scale productions. However, dedicated facilities are usually required for voice and Foley recording and mixing. A Dolby surround mix must be undertaken in a Dolby-approved mix studio and will incur mastering and Dolby licensing fees. As mobile entertainment becomes more standardized

around the globe, the audio experience is becoming more a “focal point”. New tablets and devices are available with Dolby Atmos(R), which means cinematic and immersive experiences can be created for home, Web, and mobile entertainment. VR, AR and 360 video is also an expanding market. But if a soundtrack is poorly planned and not budgeted adequately for, it will not take advantage of the technology and opportunities that are available.

### **Tech, Format, Length, and Deliverables**

Deliverables affect budgets and schedules, which in turn affect quality and outcomes. Frame rates, file types, and sample/bit rates need to be defined as well as a protocol for transferring files, sessions, and outputting material across sound and picture departments. When arranging and scheduling projects, it is important to identify and clarify any issues that could affect sound and workflows. In the case of games and interactive projects, there could be engine limitations, and the platform will influence the sound design and the mix. Games sound designers need to know how software or hardware processors will treat sound effects, and if certain sound effects or voice commands have priority. The viewing/ listening audience should always be considered when a project is devised and a distribution plan defined accordingly. VR and 360 film projects are listened to on headphones so need to sound good on different headphones. Increasingly, festival submissions include a digital cinema package (DCP), and most cinemas have or are installing DCP servers and 2k or 4k digital cinema projectors. This necessitates a multichannel surround sound or up-mix, which will need to be planned, scheduled, and budgeted for. More and more projects are, or are likely to be, cross-platform so require multiple mixes and music and effects mixes (M&Es). Archiving is the final stage in the production cycle and involves the backing up of a project in various formats and mediums to make sure nothing is lost or destroyed. Often projects are re-released at later stages, which involves revising and remixing the soundtrack in line with current standards.

Again, a sound designer/ supervising sound editor or audio director will be able to work through project requirements and identify what needs to be done and when.

### **Ancillary and Marketing Materials**

The preproduction stage is also a good time to start thinking about and planning ancillary materials such as teasers and trailers, which will affect budgets and schedules. Trailers are frequently thematic, which means deciding on what shots and shot arrangements are going to be used. Narration, key dialogue lines, music, and spot effects usually drive trailers, so selecting visuals and doing a visual edit is problematic without sound. Increasingly common is the production of other materials such as teasers or “behind the scenes” clips, which also involve sound. With the advent of VR filmmakers are also creating VR experiences to compliment marketing materials. All additional content requires sound so needs to be considered alongside the main project.

### **Voice Casting**

Aside from vocal-oriented sound design, sound designers are not usually involved in casting for film or animation unless the project is low budget and they possess the necessary skills. Conversely, it’s not uncommon for sound designers to have experience in selecting and directing voice talent, dialogue recording, and editing, but it should not be assumed. Voice casting for animation and games is another dedicated and specialized role and is generally handled by the director and/or a casting director. If an experienced sound designer or supervising sound editor is formally involved, then he or she will be responsible for overseeing, managing, and guiding the process in collaboration with the director and producer.

The first step in voice casting is defining the types of voices that are needed through character designs/models and descriptions, references, and other development materials. Human characters tend to be a little easier to define in terms of gender and age, but as animated characters can be anything from aliens to lamps, deciding on gender and age is not always clear. Props can also speak. Does the character have feminine qualities or masculine qualities? Should he or she have an older or younger voice? Does he or she have an accent or specific speech requirements such as lisps, stammers, or stutters? If a character is large and menacing, should he or she have a voice to match, or perhaps the opposite if the genre is comedy and/ or the character has specific personality traits that conflict with appearances? Most talent and voice agencies have voice samples online, and listening to artist demos is a good way to get a clearer idea or ideas. If working with an agency, they will review any information and make recommendations. After talent is selected, recording materials (cast list, character descriptions, models, reels and recording scripts for the voice talent, recording engineers, and director) are compiled and sessions scheduled. Casting sessions are usually recorded so that the director can select the preferred voice(s) to be contracted. Countries have different rates and fees, and territorial rights need to be negotiated, ideally worldwide rights. Sometimes a voice actor will play a number of characters, which can be a little cheaper if there are small or many incidental characters. This needs to be checked against any union regulations because some countries have regulations regarding how many parts an artist can perform in a given project. Before recording rehearsals are conducted, allow time for actors to get into character and address any script issues, which reduces the time spent in recording studios.

### **Recording**

In animation and games, once a script is locked, a recording script is prepared. A common way to do this is to number each line with even numbers and use

odd numbers for alternative and offscreen lines and additional vocal material such as grunts and groans. All recordings need to be named as per the project “naming convention” as they are recorded (to a DAW), or recorded on separate tracks that are named as per the character. When the dialogue is broken down, the dialogue editor can number each take with the same character, scene, and line (e.g., BOB\_sc1\_0010\_tk1; for an alt, BOB\_sc1\_0011\_alt1; and for a grunt, BOB\_sc1\_0011a\_grunt1). Not identifying recordings slows the dialogue break-down process and makes it difficult to track files. A large-scale project can involve hundreds to thousands of dialogue lines/files, and anything that slows a project down costs money.

Animation scripts can then be stripped of everything but dialogue or just left as is, with each character highlighted for the corresponding actor. Creating a dialogue recording script makes it easy to mark off what has been recorded so that nothing is missed. A full script should always accompany a recording script in case anything needs to be double-checked. During recording sessions, the director or voice talent may make changes, which should be noted and added to the final script. It’s important to record any off-screen dialogue and vocal elements such as grunts, groans, breathing, sighs, inhales/exhales, exertions, laughs, screams, and any other voice-related sounds that a character is likely to make, which also applies to live-action films. A useful tactic is to go through the script before recording and add these to the recording script. Additionally, if there is any debate over particular dialogue lines, “alts” (alternatives) can be added to the recording script. Scenes that require walla should also be noted. Voice actors can then be grouped to perform walla such as crowd noises and background conversations. Recording multiple takes of even a small group of people can be layered to create a large group. If any background conversations need to be “audible” in the mix, they should be scripted and added to the recording script. Doing this early on will prevent the

need for additional recording sessions due to oversights and missing information.

Commonly, actors are recorded separately, although some directors prefer actors performing scenes together. Gore Verbinski opted for recording the actors together on *Rango* (2011) because he wanted to avoid performances that were unnatural and lifeless. Instead of reading lines to match animated characters, the cast was filmed so animators had reference material to inform the characters. If characters are running, you expect them to be out of breath when they stop and start talking. The downside to this approach is when lines overlap, it can cause difficulties for dialogue editing, which is something to be aware of when directing group recording sessions unless planning to do ADR at a later stage. The solution is using multiple microphones, which means a bigger recording team. The upside is a more realistic, energetic, and “animated” performance. Work out a strategy that suits the film, and organize and prepare the appropriate documentation and materials.

- Cast list
- Numbered script
- Recording script/ADR cue sheets
- Character descriptions
- Model sheets/illustrations
- Storyboards/reels/animatics

### **Copyright**

Licensing music and songs can be expensive, time-consuming, and complicated. One of the big mistakes people make is assuming they can use a commercial track and writing it into a script without budgeting for it. Another oversight is not writing it into the script so copyright and licensing is overlooked. Copyright owners have exclusive rights over the music, and using

music in a film is not considered fair use. To avoid legal issues, filmmakers need to acquire the necessary licenses before including any music in their films. If a project relies on particular music tracks or is musically oriented, the budget needs to factor in rights; otherwise, music requirements will need to be reassessed if cost-prohibitive.

Music is unique to copyright law because it has two copyrights, one for the song or track (synchronization) and one for the actual recording of the song or track (master), which means a specific recording of a track will often require separate licenses. When a filmmaker wants to use a song in a film, he or she must acquire a synchronization license, which only applies to the musical composition. It allows for the reproduction of the musical composition and synchronization with the visual images. The downside is the track needs to be rerecorded, which can also be expensive. If a filmmaker wants to use a specific recording of a song, he or she needs a master use license. If a filmmaker wants to release a film soundtrack, then he or she must also obtain a “mechanical license,” which grants the right to reproduce and distribute the composition. In order to obtain a license, a filmmaker must find out who owns the copyright. This information can usually be found on CD packaging or through the record label, artist websites, and organizations like the Music Publishers Association of the United States, the Australasian Music Publishers Association, and the Music Publishers Association (UK). Artists generally assign the copyright of the musical composition to a publishing company that administers licenses and distributes royalties to the artist. The copyright of the sound recording is usually owned by the record company, which administers the master use license and distributes royalties to the artist. To acquire the master use license, the filmmaker should contact the record label itself. Most media companies have online systems and music supervisors or rights clearance people who deal with licensing. Music supervisors are responsible for overseeing all music-related aspects and have specialized knowledge of music licensing and

negotiation. Music licensing costs also depend on duration, which needs to be specified; the territory (United States, United Kingdom, Europe, the world); the type of media, (TV, DVD, theatrical, online); and the term, (one year, five years, perpetuity). The most common and cheapest is a limited-term festival license, and the most expensive is worldwide all media in perpetuity. Music cue sheets and accompanying song titles, which will include the duration of the cue, the artists performing the music, and the publisher(s), are also required for commercial distribution.

The other options for music are:

- Composers
- Unsigned/independent acts/bands
- Library music
- Sound design (as score)

### **Composers**

A key factor in getting great music is getting a composer involved in a project as early as possible. Discussing requirements and ideas early can also eliminate the need for and reliance on temp tracks. A composer can provide rough ideas or sketch tracks, which can be used for reels, in animatics, and in the rough edit. The composer chosen for a project needs to be skilled in the intended genre as well. If a composer specializes in composing orchestral scores and the project needs hardcore dub, the results could be alarming. Music can be difficult to budget for, but an experienced composer or music supervisor will have a good idea of the work each cue involves. In the case of musicals or films involving song and dance, animators need the music tracks, or at least temp tracks, to work with as early as possible. In *Strange Magic* (Rydstrom, 2015), the intention was to tell a story with popular songs from the last six decades, matching the words with the story line. The film was inspired by William Shakespeare's *A Midsummer Night's Dream*, mixing fantasy and adventure to tell the tale of a group of elves, goblins, imps, and fairies battling



over a mysterious potion. Music producer Marius de Vries served as both musical director and composer and collaborated with music supervisor Steven Gizicki to create new cast performances of the selected songs. *Chico & Rita* (Errando, et al, 2010) tells the story of a lifelong romance between two Cuban musicians; music and music history are the greater part of the narrative. The film is dedicated to Cuban pianist, arranger, and bandleader Bebo Valdés, who was also responsible for the original music, and a number of other pioneering Cuban musicians from the 1940s. Trueba had selected tracks rerecorded by three different bands in Havana, New York, and Madrid. The film also includes cameos by jazz icons such as Dizzy Gillespie, Charlie Parker, and Nat “King” Cole, interpreted by living musicians “playing” in character. Some films are not musicals but feature music being played. In *The Conversation* (Coppola, 1974), sound is a large part of the narrative, surveillance expert Harry Caul also plays the saxophone in the film, and the music was also recorded before principal photography. When music is integral to the narrative, it must be addressed as early as possible.



Fig 4:9 *Chico & Rita* (2010, dir. Tono Errando, Javier Mariscal, Fernando Trueba), *Isle of Man Film, CinemaNX, Estudio Mariscal*



*Fig 4:10 The Conversation (1974, dir. Francis Ford Coppola), Directors Company, The Coppola Company, American Zoetrope*

### **Library Music and Unsigned Artists**

The easiest and most cost-effective kind of music to access is library music. In the case of period music, there are websites where music out of copyright can be downloaded for free. Stock library music is usually classified by genres and available for a nominal fee. There are still license agreements, and producers of library music earn fees when their music is broadcast; broadcasters pay a local collection society when a piece of music is used. Library music can work if all that's required is relatively generic tracks for source cues, such as background music in a bar. The downside to using stock music is that the track may feature in numerous other projects. A visual equivalent is using stock footage, templates, and clip art instead of original and custom-designed material. Library and pre-existing tracks are also rarely a perfect fit, so need editing. There can also be issues regarding the quality of the actual recording. Unsigned bands and musicians are another alternative for sourcing music.

It's still advisable to devise a licensing contract and specify the terms of use, even if no money changes hands.

### **Sound Design as Score**

As sound design can have a musicality, it can function, and be perceived as, music, but unless a sound designer defines his or her work as music, it's not normally treated as a copyright concern, which can be a really cost-effective alternative to music. This type of approach still needs to suit the scene and film so should be discussed as early as possible. The Coen Brothers initially conceived *Barton Fink* without music, just dialogue and sound design, but without music, the film would've felt quite different. Always think about what's important for the film and keep in mind any budget limitations or implications.

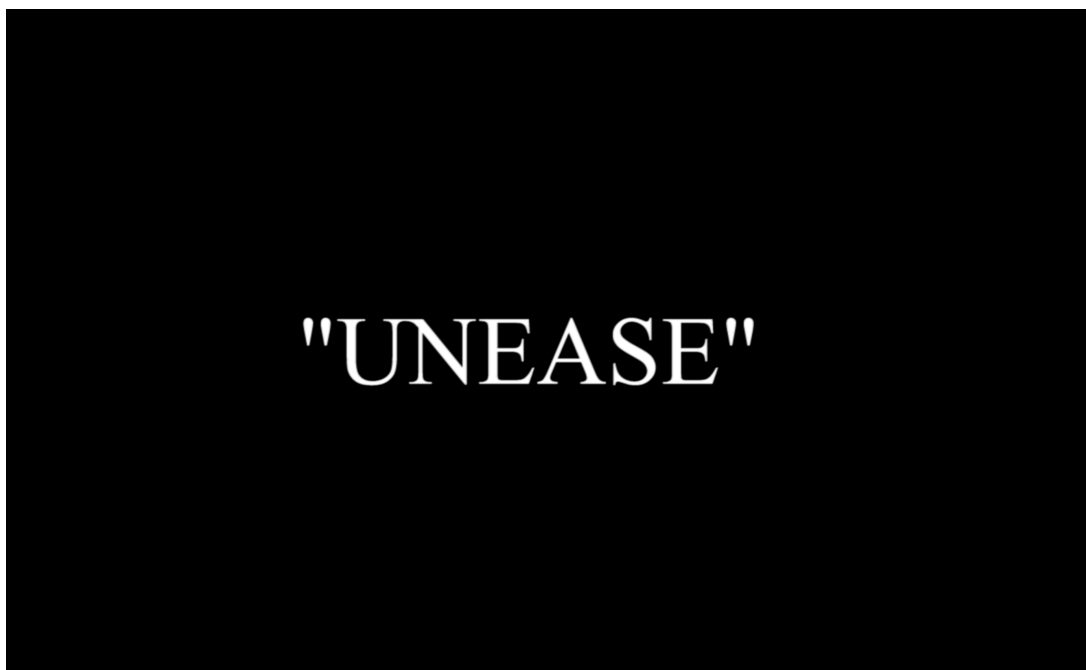
In summary, a successful outcome hinges on considering sound and story. The right time to start the process is when writing a script, before the script is finalized. Once a film has been shot or animated, the creative options are reduced. The absence of attention to sound in preproduction has a flow-on effect into production, postproduction, and distribution. To compete internationally, independently produced films need to be of a certain "quality." Distributors and festival selectors are unlikely to select films with "bad" sound. If sound practitioners spend increasingly limited time on problem solving, then creativity is marginalized. A film might look great, but audiences do not engage with "poor" soundtracks. Paramount to collaboration is communication, the ability to communicate ideas, which starts with the script. Preproduction materials contain a wealth of information, and solidifying production relationships and responsibilities ensures that everyone involved is "in tune" with what needs to happen, when, and why. Available resources can be assessed and an appropriate workflow defined. Arrange a meeting with the production mixer, sound designer and/or supervising sound, and the film editor to sort out a workflow, and any project dependent specifications or requirements. For live-action films, hiring a good production sound team is essential. The costs associated with audio postproduction

can be prohibitive for independent producers and directors working with low budgets. Engaging a sound designer or supervising sound editor in preproduction means budgeting can be addressed to maximize available resources. Music can be expensive, so music requirements need to be addressed very early on. Short films can also pose difficulties for composers. A very short scene hinging on music can be challenging, abrupt changes can feel abrasive, and too much music can make a short film feel more like a music video. Another key issue to be mindful of is having sound designers and composers working on the same scene unaware of each other, which can cause mix problems. Ideally, the sound designer and composer are collaborating throughout production, for the benefit of the final mix. Production problems will always arise, but having an overarching production ethos helps isolate creative opportunities and address problems common to most projects.

### **Sound Design SFX & Textures (online)**

Sound in film is designed, which can involve generating sound/s from “scratch”. The associated online clip is a number of “raw samples” generated as part of the sound design process for various projects, through the use of “found sound”, synthesizers, virtual instruments and samplers. By generating, extracting, combining, altering, re-shaping and “abstracting” specific qualities, new and unique sounds and sound “textures” can be created, in the same way earlier sound artists like Pierre Schaeffer created “musical compositions”. The initial *process* of generating sound design elements for films comes from reading scripts, looking at mood boards, visual treatments, storyboards and through conversations with directors. Frequently a word, phrase or reference to a psychological or emotional state triggers ideas for non-literal sound design elements, blurring the line between sound effects, soundscapes and music, and often to such an extent that audiences and film reviewers “mistake” sound design for musical score. Figure 4:11 is from the online clip, which illustrates 1) how

a word can elicit sound ideas and 2) how sound design textures can “pose” as “music” effectively blurring the line between sound and music.



*Fig 4:11 Sound Design SFX & Textures*

Often people underestimate the time involved (and technology) in designing new sounds and creating libraries for a specific film project, which is why the earlier a Sound Designer is involved the better. Sound Effect and Sound Design libraries can be created during pre-production and production, which can be helpful for the picture editor. Depending on the project, if a film or scene suits a “sound design” driven approach, original sound design material can instead of using temp or scratch tracks. It is difficult to articulate and communicate sound design ideas so creating material in response to a word, an image or a script is a “practical” way in which sound designers can collaborate with directors and other visual artists. If a director wants a scene to feel “*uneasy*” it may be that creating and mixing a sound design *element* subtly into the room tone or atmos is what he/she is asking for.

## CHAPTER 5: PRODUCTION

Once a script, storyboards or reels, and shot lists are approved, a project enters the production phase. Production is a coordinated process with personnel working together, utilizing resources, to achieve a set goal within a specified budget and time frame. In live-action, production centres around the shoot and production sound, whereas in animation there is more of an overlap between the production and postproduction processes. However, different studios and production companies customize pipelines relative to the project and available resources. For sound, the production stage can involve everything from recording, to sound editing and design, through to premixing. Some sound designers work in-house, which means they are employed by a studio full time, while many are contracted in as projects arise. Freelance sound designers working on smaller films are frequently asked for a “package deal,” which generally means combining services and often managing the entire project, effectively functioning as a supervising sound editor or audio director. This can involve hiring a production sound mixer for live-action shoots and booking talent, recording, and mix facilities. While most sound designers will have a background in production sound, sound design is a specialist role, and most sound designers do not undertake production sound. Sound effects recording is usually a separate task from production sound, and the territory of sound designers. On large-budget productions, a dedicated separate sound effect recording team is often hired, particularly if there are specific effects such as vehicles or certain props that need to be recorded.

### **Capturing Sound**

Sound recording is like cinematography: A cinematographer needs to have a good eye, and a sound recordist needs a good ear (and eye). Cinematographers understand lenses in the same way sound recordists understand microphones. A cinematographer needs to be able to frame and recognize good shots; a sound recordist needs to be able

to recognize and “frame” good sound. Understanding lighting is like understanding acoustics. Overexposure occurs when too much light is reflected into the camera, rendering an image that is brighter than normal exposure. Underexposure is the opposite. Checking exposure is analogous to checking sound levels. Light meters are used to help determine the exposure and were a necessity in early film because until the film was developed, nobody could be sure if the exposure was correct. With digital cameras, you can see the image in real time, and most cameras have light meters. Audio metering is just as important, and the much the same, except we can’t see sound, which makes it more difficult to monitor.

### **Digital Audio Fundamentals**

To understand sound recording requires a basic knowledge of digital audio. Pulse-code modulation (PCM) is the main method used to digitally represent analogue signals and was invented in 1937 by British scientist Alec Reeves. Reeves wanted to make higher frequency radios that could carry several calls at the same time, but he found that they interfered with each other. He discovered that converting these waves, analogue representations of speech, into a digital form helped eliminate interference. However, due to limitations of technology at the time, there was no way of converting the digital signal back to an analogue signal for reproduction. Digital recording is data intensive so was somewhat impractical until the invention of the microprocessor. Nagra-brand tape recorders were the standard sound recording system for film production from the 1960s until the 1990s. During the 1990s, digital audio tape (DAT) recorders became reliable enough to use in the field, and around the same time, Nagra released a four-channel PCM digital audio recorder.

A PCM stream has two basic elements that determine the fidelity of the original analogue signal being recorded. The sampling rate (or frequency) is the number of times per second that samples are taken, and the bit rate/depth determines the number of possible digital values that can be used to represent each sample. Common

sampling frequencies are 48 kHz and 44.1 kHz, 44.1 kHz is the standard for compact discs (CDs), and 48 kHz the base standard for moving image and broadcast audio. Sampling is the method of converting an analogue signal to digital data— essentially the reduction of a continuous signal to a discrete signal. A useful analogy is animation; the human eye is fooled into seeing “lifelike” moving images when a succession of still images are presented at 24 or 25 frames per second (fps). Digital sampling takes snapshots (samples) of information at quick and regular intervals to recreate a constant waveform, a continuous line of information, which is represented numerically by a digital system at specified points in time. Subsequently, the quality of a digital recording increases with the number of samples taken.

The Nyquist theorem, also known as the sampling theorem, is the principle that underpins the digitization of audio. For analogue-to-digital conversion (ADC) to result in a faithful reproduction of the original waveform, samples must be taken frequently, at least twice the highest frequency contained in the original signal. If the sampling rate is less, some of the highest frequency components in the analogue input signal will not be correctly represented in the digitized output. When a digital signal is converted back to analogue form by a digital-to-analogue converter (DAC), false frequency components can appear that were not in the original signal and result in a form of distortion called aliasing. As few people can hear above 20 kHz, the sampling rate for digital audio needs to be at least twice that frequency, or 40 kHz, hence the standard audio CD rate of 44.1 kHz. Dynamic range, the difference between the loudest sound and the quietest sound, is often described as a ratio and commonly notated in decibels. The human ear can perceive sound amplitude between 0 dB and 140 dB sound pressure level (SPL), which means the dynamic range of human hearing is roughly 140 dB. If a music track ranges between 10 and 100 dB SPL, then it yields a dynamic range of about 90 dB. Recordings at 16-bit resolution have a theoretical dynamic range of 98 dB, and 24-bit a dynamic range of 120 dB. Bit and sample rates are often debated. If the typical frequency range of human hearing is 20 Hz to 20 kHz, then why record at higher sample rates if nobody can hear it anyway? For most trained



ears, there is actually an audible difference between rates. Additionally, the greater the dynamic range is, the lower the noise floor, which allows for the recording of very quiet passages without introducing any resolution related noise. If you're down sampling and file converting, say in the case of creating/ implementing game sound effects it's better to record raw material at a high/er sample/bit rate. Perceived quality is also influenced by other factors, such as the listening environment (ambient noise), hardware, software and audio equipment (such as sound cards, speakers, and headphones).

The PCM process includes three steps: sampling, quantization, and coding. The original signal is sampled to produce corresponding pulses and then quantized, which means a value from a given set of values is assigned to each sample of the discrete signal. The quantized forms of the samples are then converted to binary digits and are outputted in the form of 1's and 0's. Quantization errors occur when a digital audio sample does not exactly match the analogue signal strength it is supposed to represent (in other words, the digital audio sample is slightly higher or lower than the analogue signal). Quantization errors are also called rounding errors because imprecise numbers represent the original analogue audio.

## **PRODUCTION SOUND**

While most sound designers and supervising sound editors are not physically involved in film production sound, they often coordinate with production sound teams because of the impact production sound has on the quality of the soundtrack. Production sound is sometimes referred to as location sound because live-action films are recorded on locations or sound stages. Production sound is recorded at the same time as the recording of image (or principal photography). A production sound mixer is responsible for recording dialogue, room tone, atmos, and sometimes sound effects. The main priority is capturing good quality dialogue and separate recordings of room tone and atmos. Production sound can also include the recording of "wild tracks,"

which refers to additional atmos, sound effects, or extra takes of lines performed for audio only. Recording extra dialogue lines is a cost-effective way of undertaking ADR on set. Problem lines are recorded “wild” while actors are still in character, and in the acoustic environment of the scene. Production sound recording is either “single system,” which means audio is recorded directly to a camera, or “double system,” which means audio is recorded to a separate recorder. The recorded production sound is then later combined with Foley, effects, music, narration/ VO, walla and rerecorded dialogue (ADR).

### **Metering**

One of the key areas of confusion is assessing sound levels is the difference between meters used for monitoring sound, specifically the difference between analogue and digital meters. Audio workflows begin with microphones and end with speakers, which are both analogue devices. The volume unit (VU) meter was originally developed in 1939 to measure complex audio signals. VU meters “average out” peaks and troughs of short duration (transients) and reflect the perceived loudness of audio material. Some practitioners prefer VU meters because they are closer to the human ear’s perception of sound level, although they do not adequately reflect peak levels, which can be problematic. Depending on the amplitude and the duration of peaks in the signal, some transient sounds barely register and can cause overloads. On an analogue meter, 0 dB is the optimal recording or output level of a device. If the voltage is much higher, the signal may distort. If the voltage is much lower, the signal may be lost in any noise inherent in the recording chain. VU meters are typically seen on standalone location audio mixers and analogue mixing desks. When a VU meter is reading 0 VU, there is around 20 dB of headroom (the safety zone) for any fast, transient peaks. +4 dBu (a logarithmic voltage ratio) is the nominal operating level, and +24 dBu is the typical clipping point. Digital meters generally show transient peaks, and the clipping point is always 0 dBFS (full scale). This means to allow the same kind of headroom in a digital system (as in an analogue system), the average

signal level needs to be metering around  $-20$  dBFS. Digital meters are always scaled so that the maximum quantization level is denoted as 0 dBFS, which is the maximum level a system will handle without clipping, and why the alignment level is always a negative value below this point, most commonly  $-20$  dBFS in audio postproduction workflows.

In digital audio systems, even a brief peak can cause clipping, so a basic rule of thumb is to allow 6 dBFS for transient peaks. Digital meters are easier to read because they show the entire headroom margin and have a red LED that serves as a clipping indicator, so if a level exceeds 0 dB, the LED will light up. “Clipping” is the term that refers to an overloaded signal path; when examined, it will appear as if the top of the waveform has been “clipped” off. Clipping is like overexposing a shot, and recording a low-level signal is like underexposing a shot. Clipping sounds harsh and cannot be fixed, so renders a recording unusable. The easiest way to avoid clipping is to make sure there is at least 6 dB of headroom, which means setting levels so that the loudest portion of a recording peaks at around  $-6$  dB.

### **Production Sound Mixer**

The sound mixer is considered a department head and is responsible for all aspects of production sound, which includes the hiring of a boom operator and utility person, preparing and testing the sound equipment to be used on the set, planning the recording setup, determining which microphones are used for each scene, deciding on sound perspective, operating the sound recorder, alerting the director to any sound problems, keeping sound levels consistent, watching for boom shadows, and maintaining the sound report. Sound reports are the production reports and notes created to keep track of everything recorded. They inform everyone as to what was recorded (scene/ takes), how it was recorded (how many tracks, mono or stereo, “safety” tracks, track assignment, sample/bit rates, microphone selection), and general notes, which incorporate any issues.

**Boom Operator**

The boom operator assists the production sound mixer and operates the boom microphone, which is either handheld on a boom pole or dolly mounted on a moving platform. If lavalier (or lapel) microphones are required, the boom operator will position them correctly, either on sets or on actors. Boom operators are also responsible for testing the sound equipment and making sure it's in good working order.

**Utilities Person**

A utility or cable person assists both the production sound mixer and the boom operator on set. He or she helps with setting up equipment, running cables, and adjusting microphones and will sometimes function as a second boom operator when required.

**On Location**

Production sound practitioners encounter a wide array of challenges during a production shoot. Issues range from needing to record multiple moving actors, difficult locations, and tight schedules, to crewmembers adding unwanted sound. Location and crew problems are never intentional and sometimes unavoidable; however, there is a tendency to confuse not being seen (on camera) with not being heard (on microphone). What is being shot is considered the priority, not what is being recorded, which can create issues for audio postproduction. If dialogue recordings are problematic, then dialogue needs to be rerecorded and the process becomes much like creating an animation soundtrack. Many emerging and independent filmmakers overlook the magnitude of this.

Sound and Foley effects are usually recorded in dedicated sound studios, whereas atmos and room tones are typically created from production (or field) recordings. Sound effects that cannot be practically recorded in a studio, such as gunshots, are recorded on location. Eliminating background, reflections, and other sounds (unless

recording atmos, which is essentially background sound) is one of the main problems encountered when recording on location. If a scene requires footsteps on concrete, it's difficult to isolate footsteps from background sound, even in a quiet location with a highly directional microphone. While certain frequencies such as AC (air conditioning) or a low-end distant traffic rumble can be rolled off (bass roll off), it's difficult and often impossible to completely remove unwanted background sound. More often than not, you're removing part of the sound you want to record in the process. Most production mixers will avoid using any EQ or filtering during filming, especially when recording dialogue.

For animated films, certain locations can provide the perfect atmos and room tones if they match the visuals. In an "INT. City Apartment, Kitchen," you would expect to hear a fridge hum and background traffic. If a scene were set in a kitchen, in an isolated country cottage, prior to the invention of the fridge, then the background traffic and the fridge hum would need to be removed. As it's difficult to effectively remove elements without altering the sound, it's important to be aware of how different environments sound. It's also easy to "overlook" subtle and short duration sounds that become more apparent when atmos or room tone is looped (i.e., repeated). It's also important to be aware of environments like shopping malls with music playing as this can pose a potential copyright issue. Music can always be added but not removed from a recording.

Doing "a recce" (a pre-shoot reconnaissance of a film location) is a filmmaking term used to describe a pre-shoot location visit to assess its suitability for shooting. A recce involves ascertaining likely or potential problems, including sound issues such as unwanted background sound. Doing a recce is an opportunity to listen to and assess a particular environment. It's also worth taking a recorder to record, for reference, which could even suffice for atmos and room tones, potentially eliminating the need for further SFX recording sessions for animated films, and as a way of building up

sound libraries for use at a later date. Other factors to consider are the time of day/night, the season/ weather, and the need for additional equipment such as microphone windshields and sound blankets for dampening. There are a number of common problems location sound people encounter, which can often be solved before recording.

### **Common Problems**

- Background sound: traffic, people, dogs, birds, cicadas, sirens, cars, aircraft, trains
- Building/machinery: AC units, fans, elevators, clocks, lighting fixtures, computers/ monitors, fridges, freezers
- Excessive reverb: overly reflective rooms/ surfaces
- Weather: wind, rain, lightning and thunder
- Human error: microphone handling, noisy clothing/shoes, mobile phones ringing in the middle of a recording, clipping (distortion)

### **Common Solutions**

- Reposition the microphone and/or sound source (*to eliminate/reduce background sound*).
- Avoid recording in overly reflective rooms/ within opposing flat surfaces; reposition the microphone and/or sound source (*to avoid excessive reverberation*).
- Shut doors/windows (*to eliminate/reduce background sound*).
- Wait until the unwanted sound disappears (*such as cars, trains, planes*).
- Record at night (*a quieter period*).
- Disable, turn off, or remove any noisy equipment.
- Use a windshield (*or record on a less windy day*).
- Use a boom or microphone stand (*to eliminate microphone handling noise*).

- Do not wear noisy clothes/jewelry/shoes (*to avoid unwanted sound*).
- Always monitor audio levels (*to avoid clipping or recording at too low a level*).
- Employ a mike attenuator (*when recording extremely loud sounds*).
- Always use headphones (*so you know what is being recorded*).
- Record multiple takes (*so there is plenty of leeway for editing*).

### **Recording Dialogue for Animated Films**

Animation dialogue is usually recorded in a dedicated studio, although recording dialogue on location has become a popular alternative. When actors are employing the full range of movement, their vocal performances can sound more natural and realistic compared to standing in front of a stationary microphone in a studio. Recording dialogue on location can also reduce the amount of postproduction work required; there's no need to add room tone, reverb, or atmos. This can work, but only if the acoustic environment matches the visual, or intended visual environment, and the acoustic environment is controlled. On the stop-motion animated feature film *Fantastic Mr. Fox* (Anderson, 2009), director Wes Anderson opted for recording the cast on similar locations instead of using the traditional studio method. The recording sessions were treated like a live-action shoot.

In live action, the boom operator (or swinger) is always limited by the framing of a shot. For animation dialogue recording, the microphone can be positioned closer than is typical for live-action shoots because there is no principal photography. *Fantastic Mr. Fox*, based on the children's book by Roald Dahl, is about a fox who steals food from three wealthy farmers. The farmers retaliate and try to kill him, his family, and the other animals that live near the farms. Interior scenes were recorded in similar farm interiors, such a make-shift chicken house and a horse trailer. Exterior scenes were recorded outside, by a river, or in the woods to correspond with the visual locations.



*Fig 5:1 Fantastic Mr. Fox (2009, dir. Wes Anderson), Twentieth Century Fox Film Corporation, Indian Paintbrush, Regency Enterprises*

Recording dialogue on a sound stage concurrently with motion-capture is also becoming a popular method for animation and games projects. Actors wear lavalier microphones on their foreheads or motion capture helmet, plus a boom can be used to capture different perspectives and serve as a backup. Recording dialogue on sound stages means the sound team needs to be very conscious of reflections and other sounds. Empty soundstages can sound quite “live,” which is not ideal for recording dialogue. Motion capture suits, head-cams, computer servers, and props can also create unwanted sound. Baffles, heavy drapes, and matting are used to reduce reverb, and installing any servers in treated boxes or off set helps reduce unwanted sound and reflections.

On *Rango*, production mixer Lee Orloff and a recording team spent three weeks on Universal’s Stage 42 soundstage to record the cast performances. It was shot like a live action film, with a number of cameras, to provide the animators with the actors’



facial expressions as a reference, while also documenting spatial relationships and blocking. The sets were mostly “virtual,” with some physical elements such as an oak bar, a wagon, and a wheelchair. The production remit for sound was to capture the highest-quality production material so that it could serve as the entire dialogue recording for the film. Preproduction tests were conducted to work out how to control the acoustics of a large, and largely empty space. The recording team silenced props, installed portable sound walls, and used both fixed and portable baffles to dampen sound reflections and lower the ambient noise floor. Portable rigs were used for referencing playback, video storyboards, sound effects and music cues that Verbinksi wanted to enhance the on-set experience for the cast.

It was huge fun. They got them all together and gave them costumes, not much, but a waistcoat, a gun holster, a hat, just to get them in the mood, and they played the scene out just as if it was a live action scene. The animators got shots of each of their characters. So there was a camera trained on Rango, and the animators would look at Johnny’s (Depp’s) performance and take aspects of his performance. Bill Nighy who did Jake the Snake, a snake, which doesn’t look like a human at all, but you can see Bill moving his head and performing, and they really looked at what he did and took that into the character. It really was quite astonishing. The real advantage was Lee could put microphones on everyone because the image wasn’t going to be used, so he got terrific close recordings of the cast. We had to do some ADR, but very little, it was purely to change lines that they didn’t get in the shoot, because all the sound was immaculate. One particular scene I remember very vividly was the scene between Jake and Rango where Jake says “where are your pals now,” which they did together and that performance really came out of them being together. There are a lot of sequences like that. The scenes with the Mayor and Rango were very

much informed by the two of them playing off one another. Gore didn't want it to be hilariously funny; he wanted it to be unsettlingly humorous and weird and I think he hit the exact note of what he was trying to do. (Miller, 2016)

## **RECORDING SOUND AND FOLEY EFFECTS**

Recording sound and Foley effects on location, unless controlled, is difficult, because sound and Foley effects are typically detailed and “quiet” sounds, and therefore easier to record in acoustically controlled studios. Foley and effects need to be clean. Recording a Foley effect like a door shutting or slamming from an interior is easier than recording it from an exterior perspective. Exteriors are more difficult to control. Sound designers and effects editors will collaborate with Foley artists to recreate Foley sounds, usually on a Foley stage, performed to picture, and synchronized with the visual action.

Sound effects are also diverse in terms of loudness and dynamic range. Capturing loud sounds is always challenging. A door *slamming* is a loud sound with a fairly sharp attack, which poses a potential level problem, especially for sensitive condenser microphones. Decreasing the microphone gain may prevent the signal from clipping, or alternatively, using a dynamic microphone. Increasing the distance between the microphone and the door will decrease the level but increase the level of reflections and background sound. A door *shutting* is a lower-level sound, which can be close miked to reduce excessive background sound. Sound effects such as gunshots are known for being one of the hardest categories of sound effects to record. Most assume a gunshot is one sound effect, but it's actually a number of different recordings assembled, edited, and layered. Aside from the shot, there are also the quieter elements such as gun handling and metallic clicks, which means multiple microphones and microphone placements.

### **SFX Lists**

It can be difficult to remember what was recorded at a later stage, so all recordings should be slated, documented, and reported on. The fastest way to do this is to record a vocal ID (description/slate) at the head of each recording, while noting down any problems on the recording list (or sound report sheet), even if it's just "G" (good) or "NG" (No good). This can seem time-consuming, but having documentation and reports will reduce time, costs, and problems. Devising an appropriate naming convention also makes it easier to track and audition material.

### **Transfer, Edit, Name, and Backup**

After each recording session, transfer the raw material to a computer and a separate hard drive to back it up. Review, edit, and name or rename sooner rather than later because if material wasn't adequately documented during recording, some details may not be obvious when listening back. This process can also be helpful as a review period, to "rehear" what was recorded and "rethink" how elements could be treated. Sometimes just the "essential quality" of a sound recording is "abstracted," which may not be apparent during the actual recording session. Set up a library structure that makes sense for the project, such as individual folders for dialogue, Foley, sound effects, room tones, and atmos, and subcategories for specific material. This prevents valuable studio, production, and design time being wasted on additional file management tasks.

## **SOUND EFFECT LIBRARIES**

There are two options for the creation of sound effect libraries: produce your own or purchase existing stock sound effect libraries, either as collections on CD, DVD, and HD (hard drives) or purchased online as individual sound effects. Online sound effects come in various file formats, commonly .WAV, and can usually be previewed (auditioned) as an MP3. Libraries are arranged in categories to make it easier and faster to locate appropriate files. Most license agreements are standard and grant the

rights to synchronize and reproduce sound effects for any media production; however, distributing, lending, assigning, transferring, or selling copies to any third party is an infringement. Purchasing existing libraries can be time-effective, but it can become expensive if a lot of effects are needed. Additionally, at the time of auditioning and purchasing a sound effect, it could sound “right” but then sound “wrong” when heard with pictures.

The advantage of creating custom libraries is that the material is original; everyone has the same sound effect libraries. Relying solely on stock or preexisting sound effect material can result in a “canned” sounding soundtrack. It’s also very rare for even a “simple” sounding effect to be one “unaffected” sound. Most sound effects are a number of sounds that have been edited, layered, and treated in some way. Sound designers record, create, collate, and own their own libraries, which is ongoing because individual projects always require the creation of unique effects. Material can also be recorded or generated at higher sample rates than many preexisting libraries. On smaller budget projects, this is not always possible, so effects are created from a combination of libraries, existing and new recordings.

Creating an effects list during preproduction illuminates any potential issues surrounding the recording or sourcing of sound effects. At times, recording a particular sound effect is problematic, for example, the sound of a car from the 1930s. A similar motor could be replicated and recorded in a studio, but the result may not sound authentic. Hiring a vintage vehicle is costly and poses recording challenges; the recording location would need to be controlled so that no modern content is captured with the recording. Unless there is the time and budget for difficult or costly recording session(s), it is generally more practical to source preexisting sound effects. Stock sound effects are often “older” recordings and sometimes have been originally recorded on tape and later digitized, which can present a quality compromise. Often projects also require “localized” sounds, which are sounds distinct to a particular

geographical or regional location, such as native birds that are unique to a country, or the sound of pedestrian crossings that are unique to a specific city. If authenticity is important, then these types of sounds need to be sourced unless there is the budget for travel and recording sessions. In scripts, references to effects can also be vague, for example, “a gunshot.” There are numerous types and models of guns, and an M16 sounds (and looks) different from an AK-47, even though they are both classified as assault rifles.

## **STUDIO RECORDING**

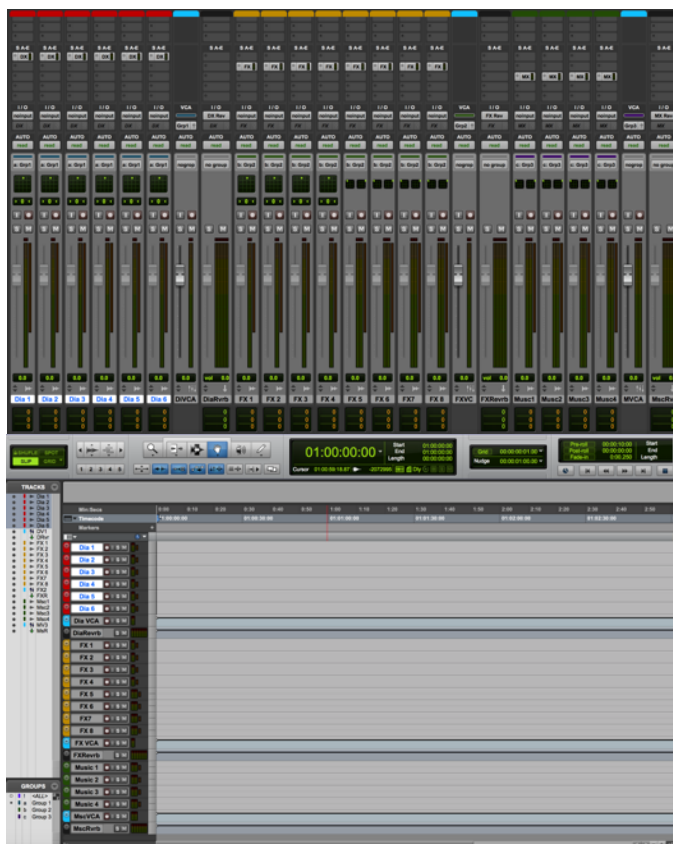
When planning a production, it's important not to underestimate what needs to be done, when, and where. In audio production, there is often confusion as to the differences between music production studios and studios designed for screen sound production. Studios are acoustically designed and equipped for specific areas and aspects of production. Depending on the type of music and scale of a project, music can be recorded and mixed in project studios, whereas full-scale orchestral performances are recorded in specially designed rooms by specially trained recording teams. While project studios can be cost-effective for various aspects of production, this can be a double-edged sword. Studio equipment, the room(s) that house the equipment, and experienced staff are important considerations. Using custom-designed recording studios may cost more, but the results are usually superior to “DIY” approaches. This also applies to the final mix; if a film or show is going to be broadcast or theatrically released, the final mix is always best undertaken in a dedicated and certified mix facility, whereas sound design, editing, and premixing can be carried out in reasonable project studios.

It can be a daunting task to ascertain and source appropriate facilities, which is why a supervising sound editor, sound designer or audio director should be hired during preproduction. On low-budget films, sound designers are increasingly taking on more roles, such as ADR, dialogue editing, and mixing, but this needs to be clarified. It's

important to make sure roles and responsibilities are clearly defined, relative to the project and associated tasks, so that appropriate facilities can be booked. Studio equipment and DAWs have become less expensive, but there are a lot of “bits” to the audio chain, digital technology is always changing and the media landscape forever evolving. High-end production facilities are expensive for a reason, but there are “staples,” and it has become more affordable to build good project studios to undertake the editing and design aspects of soundtrack production.

### **Digital Audio Workstations (DAWs)**

DAWs are now commonplace in studios and are essentially a computer software application for recording, editing, processing, mixing, and mastering audio. Most sound-for-picture studios migrated to digital during the 1990s, and one of the most common systems is Avid’s Pro Tools. Professional DAWs have a fairly standard layout: an editor, a mixer, transport controls (play, rewind, record), and track controls. Most support multiple sample rates, bit depths, frame rates, and the importing of various audio and video file types. DAWs support multiple tracks, and as with a mixing console, each track can be adjusted individually. Most DAWs also feature automation for volume and panning plus the automation of plug-ins for altering, processing, mixing and mastering sound. Musical instrument digital interface (MIDI), a common data protocol for transferring and communicating information, is also incorporated into most DAWs. MIDI information can be recorded, edited, and played back. DAWs like Pro Tools are used for various professional audio applications, particularly sound-for-picture, whereas some DAWs are geared more toward music production.



*Fig 5:2 Pro Tools Edit & Mix Windows, © 2017 Avid Technology, Inc.*

## Audio Interfaces

An audio interface allows for the recording of external sounds to a computer. Interfaces are analogue-to-digital convertors (ADCs), which means they convert analogue sound to a digital format, and vice versa, they convert digital to analogue (DAC) for playback from amplifiers, monitors, and headphones. There is an extensive range of audio interfaces available, each

of which is designed for various applications. Most film dubbing stages use Pro Tools HD or HDX systems, whereas design, editing, and premixing is often done on less expensive Pro Tools systems and then transferred to another system for the final mix. The key considerations are DAW (Digital Audio Workstation) compatibility, interface connectors, and the number of inputs/outputs (I/O). The number of I/Os relates to the

number of tracks (inputs) that need to be recorded and monitored (outputs) at the same time. An audio interface can have anywhere from two to twenty-plus I/Os. Recording an orchestra requires a number of I/Os, whereas two I/Os will suffice for recording ADR, Foley, and sound effects. USB or FireWire connections are typical for small and project studio interfaces, while newer equipment employs Thunderbolt connections. The most cost-effective option for a project-recording studio is an audio interface with microphone preamps built in, as opposed to the addition of more sophisticated (and usually better sounding) stand-alone preamps.

### **Control Surfaces**

Control surfaces are designed for DAWs and bridge the gap between old style analogue mixing desks (consoles) and DAWs by providing physical controls. They are a necessity for feature film mixes because of the number of tracks and re-recording mixers involved. Control surfaces are varied, ranging from basic iPad applications to large-format consoles used in film dubbing theaters. As DAWs have been more predominant, premixing and sometimes mixing small projects is undertaken “in the box,” without the use of control surfaces or mixing consoles.

### **Plug-Ins**

Plug-ins are the virtual alternative to physical “outboard” and have largely replaced what was racks and racks of physical “black boxes.” Today there’s pretty much a plug-in for anything: equalizers, reverb, compressors, limiters, gates, and various other effects. All DAWs come with their own set of plug-ins, which can handle most production requirements, but dedicated plug-ins and plug-in bundles are used for certain tasks such as ADR, mixing, and mastering.

### **Monitors**

Studio monitors are an important part of the audio chain because without good monitors, it’s impossible to accurately assess sound. In the same way that a microphone is designed to capture particular frequencies, speakers reproduce specific



frequencies. If you compare the built-in speakers on a laptop to even a reasonable consumer stereo system, there is a notable difference. The ideal monitor has a flat frequency response, which means all frequencies are reproduced equally. One of the main issues in speaker design is bass response; most studio monitors will reproduce mid and high frequencies relatively well, but a good bass response usually requires an additional subwoofer. Monitors are “active” or “passive.” Active monitors can be connected to line-outs of an audio interface, whereas passive monitors require a separate amplifier.

### **Headphones**

Even with a high-quality speaker system, monitoring in an acoustically poor room will pose a problem for accurately assessing sound. Studios are acoustically treated so that the room itself does not colour the sound. While headphones can be restrictive on long sessions, if monitors are inaccurate and/or a room problematic, a high-quality pair of studio headphones can be a better option, at least up to the premixing stage. It’s also important to note that when mixing projects that are going to be heard on headphones, as opposed to speakers, re-recording mixers will test the final mix on various headphones.

### **Video**

Video playback is obviously a necessity in sound-for-picture work, and most if not all DAWs have the ability to import and play back video. Sound designers and editors will use dual monitors, one for their DAW and one for video, and/or an external video monitor. When conducting ADR and Foley recording and re-recording sessions, talent and other staff need to see video, so studios use additional video monitors and projectors for picture playback.

### **Hard Drives**

DAWs have recommended or supported internal and external hard drives, which are separate from the main system drive, where the operating system, programs,

applications, and plug-ins are installed. Most DAWs perform best with approved and dedicated external audio drives, particularly for recording and mixing. Sound effect libraries and archival backups are less of an issue. Libraries can be stored and accessed from generic drives, servers, and networks, and session backups can be transferred to a formatted “work” drive if a session needs to be revisited.

### **Transfer Formats**

Sharing and exchanging media across sound and picture departments is conducted through various methods. Open media framework interchanges (OMFIs) and advanced authoring formats (AAFs) are commonly used to transfer information from one application to another, including common audio/video editing systems such as Final Cut, AVID, and Pro Tools. AAF is a newer format that supports the exporting and importing of additional information such as volume automation. The more recent material eXchange format (MXF), supplies full-time code and metadata support for video and audio applications.

### **ADR**

The primary goal when recording ADR is to obtain a clean “dead” recording so that the dialogue can be “placed” in the appropriate acoustical space. The performance needs to sound good, sync, and match the visual performance. In live-action films, ADR is conducted after production, whereas in animation and games ADR is sometimes recorded before or during the production phase. In early stages of animation production, when lip-sync is not an issue, re-recording provides the scope for improving on a temporary scratch track. If the initial dialogue was a “rough record” for pitching an idea or general timing purposes, then the script, dialogue, and intended performance can be revised. Aside from background sound and potential editing issues common in location recordings, there are some common dialogue problems that occur even in controlled environments, which are easily prevented.

**Distortion**

Voice-overs (VOs) are relatively easy to manage in terms of sound levels; it's rare for a VO to go from a whisper to a shout. General dialogue is more varied; an argument can start at an average speaking level and finish in a shouting match. If levels are set for average speaking, the shouting is likely to clip, and if they are set for the shouting, the speaking will be low level. There are a number of ways of dealing with variations in volume: adjusting the gain on the microphone preamp as the shouting starts; recording the line twice and setting levels to capture the average speaking on one take and the shouting in another, then editing the two takes together; using an attenuating pad on the microphone; getting the talent to move back as he or she starts shouting; and using a compressor or limiter to control levels. Most sound practitioners avoid the use of compressors and limiters when recording, preferring to "ride the faders." Adjusting gain during the performance is a manageable solution as long as the change is well-timed, and a number of takes are recorded to make sure lines can be edited together if there are problems.

**Plosives**

Plosives are words that start with the letters b, d, g, k, p, and t, which produce a quick burst of air, causing the microphone diaphragm to "pop" and often clip (distort). Some plosives can be edited out of a dialogue line, but a faster solution is using a pop filter, which is placed in front of the microphone or attached to the microphone stand. A typical pop filter has one or more layers of acoustically semitransparent material such as woven nylon stretched over a frame. Another solution is repositioning the microphone so the voice is slightly off-axis, though this can compromise the quality of the recording.

**Phase Issues**

Phase issues result from the voice reflecting off walls and other surfaces; when combined with the direct sound, it results in a "hollow" sounding recording. In acoustically treated ADR studios, this is unlikely, but sometimes voice can reflect off

a script or script stand. Covering stands with absorbent material and/or repositioning the script stand will minimize or eliminate any reflections.

### **Sibilance**

Sibilance is a common problem in the recording of dialogue. It sounds “shrill” or like “hissing” and is made by directing a stream of air with the tongue toward the sharp edges of teeth. Words beginning with s, z, t, and d are the most problematic. Moving the microphone slightly above or to the side of an actor’s mouth (off-axis) will minimize sibilance but can also compromise (color) the recording. In postproduction, a de-esser is used to reduce sibilance. De-essers are essentially a compressor with a filter in the sidechain, which changes the compressor’s behavior, so it only reduces gain when sibilance is present. Sibilance is often centered between 5 kHz and 8 kHz, but depending on the voice can be anywhere between 2 kHz and 10 kHz.



Fig 5:3 DeEsser Plug-in, © 2017 Avid Technology, Inc.

### Performance and Direction

ADR was originally called looping and involved recording an actor in sync to film “loops” of the image that were played repeatedly with matching lengths of recording tape. The actor would watch the image while listening to the original dialogue on headphones, and then re-perform each line to match the wording and lip movements. ADR involves two types of looping, *visual* looping and *audio* looping. With visual looping, the actor listens to the original line several times to get a feel for the delivery

before recording. When recording, the talent doesn't hear the line but watches the pictures to match lip-sync. In their headphones, they hear the new line they're delivering. Audio looping is performed the same way as visual looping, just without pictures. The line is looped so that an actor hears the line a number of times and then "mimics" it, which is easier for some people than the visual method.

The impact of body language and context on the performance of dialogue is often underestimated and the reason why some directors are averse to recording dialogue in the traditional fashion. When directing dialogue recording sessions, it can be easy to forget that a character is talking to someone on the other side of a room (not to the microphone in front of him or her) or that the character has just run up a flight of stairs (and should be a little breathless) or is anxious and paranoid (so will probably talk faster than if he or she were feeling relaxed). When ADR "fails," it's usually because it feels "flat" and there's a "mismatch" between sound and image. The dialogue might synchronize, but the performance lacks the degree of energy and emotion of the original or intended performance.

The key to capturing a quality performance is working with the talent. Actors and voice talent can get fatigued when having to do multiple takes of the same line. There's a point when the performance starts to suffer, and even ordinary words can start to sound strange. With preparation and good direction, it's possible to limit the number of takes. If an actor is struggling with a line, it can be advantageous to move on and come back to the problematic line. There is also dedicated ADR and dubbing software to help speed up the process and make it easier for actors. VoiceQ, for example, is multi-language synchronization software that integrates with Pro Tools and other DAWs. Dialogue is projected below the screen in text and waveform, with words stretched or compressed to give visual cues about how the phrasing will best match the lip movements. Scripts can also be imported and edited "on the fly" and reporting documents such as ADR cue sheets generated.

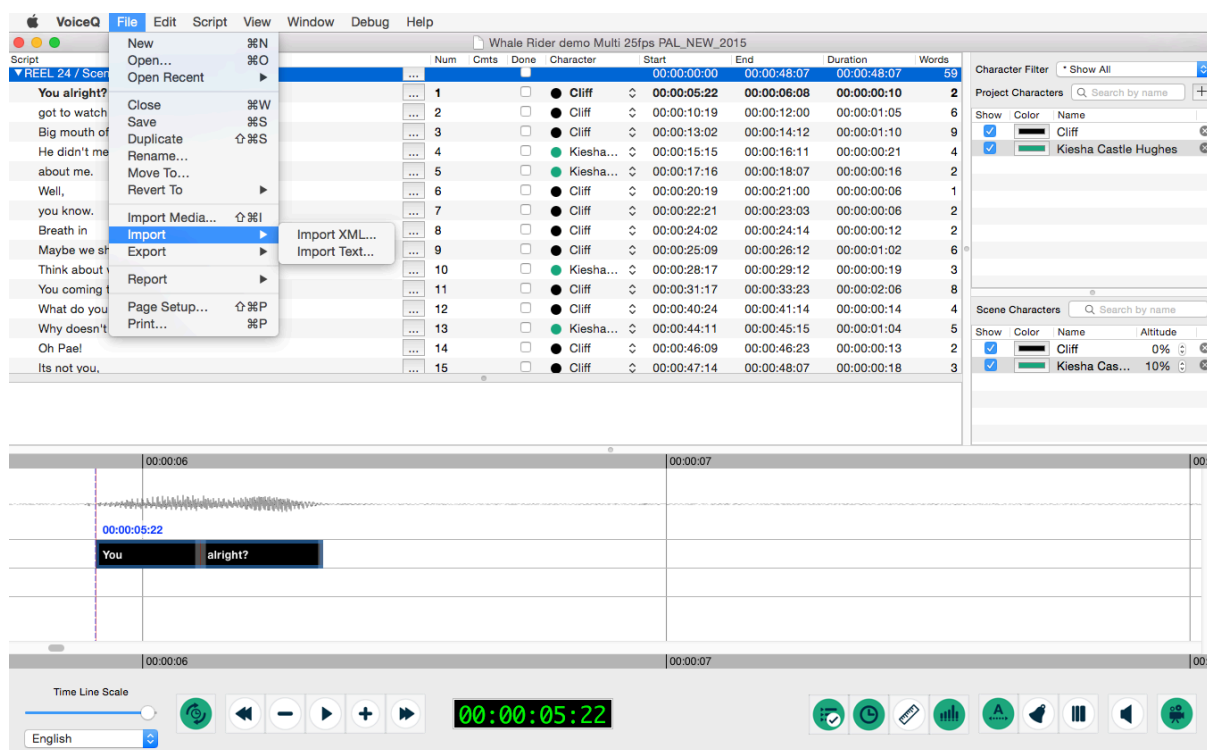


Fig 5:4 VoiceQ, Kiwa Digital Ltd ([www.voiceq.com](http://www.voiceq.com))

## Dialogue Editing

In animation and games, dialogue recordings are broken down and named or renamed so that the director can select his or her preferred take(s). ADR recordings for live action films can be handled the same way, although generally the director is always in attendance and will usually select takes during the sessions. In the same way that voice talent can suffer fatigue, so can directors when hearing numerous takes of the same line. Dialogue editors are highly skilled at ascertaining the best performances and quality of recording, which means they can select, edit, and deliver the best takes for review. During editing, dialogue is also “cleaned up.” Mouth clicks and clacks are a common problem encountered by dialogue editors and caused by lips and tongues “sticking” to the inside of the mouth. Clicks can be very audible (and visible), especially when close miking. It’s recommended that voice talent avoid drinking tea or coffee before a recording session. Drinking water can also help. Clicks can be

manually removed by “drawing” the click out of the waveform with a pencil tool, which is time-consuming but often necessary. Dedicated software like iZotope’s Noise Reduction & Audio Repair Software can also be used to address many of the problems sound editors encounter.

### **Foley and Sound Effects**

Foley and sound effects add “realism.” Audiences rarely notice sound and Foley effects because they appear to belong to the visual action. In live-action films, there has been an assumption that all the sound was recorded with the pictures. Film sets are fabricated; props are made of plastic and floors are often painted or treated plywood to look like another texture. The addition of Foley and sound effects make a scene feel real. Footsteps ground a character in an environment (shoes, texture, weight).

The traditional Foley recording stage includes a number of pits built into the floor. The pits are filled with different materials, such as gravel, and different-sounding surfaces, such as tiles for the recording of footsteps. The DIY approach is improvising using large trays or containers. The job is more difficult than it appears and requires a good sense of timing and rhythm. Every step is unique; the pace and weighting changes, so the sound of each step is always different.

Dedicated Foley studios also house Foley and sound effect prop rooms, which helps eliminate needing to source and collect sound props. Aside from footsteps, any “human”-generated sounds, such as clothing rustles, doors, windows, drawers opening/closing, typing, or sitting in a chair, are considered Foley. Sometimes a character is associated with a particular sound, which can be suggested by his or her clothing and is a subtle way of giving a character a “real” sense of presence.

Foley and sound effects are generally close miked and recorded in isolation, free of reverb and room tone. Subtle and detailed Foley effects are recorded with either a



condenser or a ribbon microphone, while louder Foley and effects are recorded with condensers that can handle high SPLs (sound pressure levels) and sometimes a dynamic microphone.

The Foley team includes the artist or “walker,” who perform sound in time to projected visuals, and a Foley recording engineer. In the case of more complex scenes, like a fight or a larger dinner party scene, two or more Foley artists may perform. Sound effects and elements that need to be recorded in a studio are usually recorded in separate sessions from Foley, typically by sound designers/editors. For short or low budget films, with minimal effects, recording session are often combined, whereas on larger budget feature films Foley effects are recorded during dedicated Foley sessions.

An alternative to Foley recording sessions is the use of Foley effect libraries, although most film projects will require some original Foley recording. A Foley library combined with a sampler like Kontakt allows you to choose from a variety of different footsteps and “play” them back on a MIDI keyboard. Libraries come with a range of shoes for men or women—a right, left, and scuff—and by automating the tuning and velocity layers, you can alter each footstep to mimic the way people walk. Playing a footstep harder makes the footstep heavier, to reflect a character’s weight.

Foley Artist, John Simpson has worked on numerous films over the last thirty years, which include *Mad Max: Fury Road* (Miller, 2015), *The Hobbit: The Battle of the Five Armies* (Jackson, 2014), *The Desolation of Smaug* (Jackson, 2013), *An Unexpected Journey* (Jackson, 2012), *The Lego Movie* (Miller & Lord, 2014), *The Great Gatsby* (Luhmann, 2013), *Les Misérables* (Hooper, 2012), *The Adventures of Tin Tin* (Spielberg, 2011), *Happy Feet* (Miller, 2006), *Happy Feet 2* (Miller, 2011), and *King Kong* (Jackson, 2005). Simpson built up industry contacts after working as a projectionist at the South Australian Film Corporation at the beginning of his career. He initially wanted to be a cinematographer but met a sound recordist while doing work experience on location, which led to an interest in post-production. Simpson

now runs FeetnFrames, a Foley studio on a 300-acre property in remote rural South Australia, which records, edits, and mixes Foley track for a wide range of film projects. The remote setting also enables him to record location-based Foley and effect recordings such as gunshots. He is licensed to record shots from almost any type of weapon and has access to hundreds of modern and antique firearms.

I love to create and try new things, so getting into Foley was just perfect for me. It took me five years to become a Foley artist. To begin with I was doing things like sound transfers, running the projection room, loading the magnetic dubbers—back in the day that's all we used. In 1982 when I started to record foley, it was only over three tracks, feet on one, fx on another, and then the cloth track. We have up to five people in the studio at times, all doing feet together. With digital technology, it's mostly one artist doing everything, and we have gone from three tracks to over 100 on some large-scale films. The greatest advancement today is the digital recording platforms, such as Fairlight (my preferred system) as well as Pro Tools, which is a real time saver, and we need it, mostly because the budgets are just getting smaller. My rate for standard type feature drama has not changed since 1997. In fact, we've had to go cheaper to fit into current budgets, plus with advancement in film now, where it's all shot on digital camera and the editing process is such that a director can swap shots and recut so easily, that then affects us down the line to try and make things we have recorded work with the new cut, or try and get extra funds to rerecord, with the latter hardly ever happening these days.

I think one of the main things for filmmakers from all areas to look out for is props—give an actor a prop and they will do stuff with it, then whatever that is, I have to make its sound! I've done plenty of indie

films and on most of them a lot of favors are pulled in from actor friends etc. to really make a low-budget film look amazing for little cost, but just remember that all that nice cheap action has to have a Foley track, at least for M&E purposes, plus the rest of the soundtrack, so keep a bit of money aside.

Foley really is the sprinkle of icing on an indie film; it will add great detail to those delicate shots, and just that alone can change the shot mood. If your location is a noisy one, then it's very hard to get any detailed sound from the location sound. In the sound editing process all the gaps between words will be taken out, leaving only the clean dialogue, and that's where Foley comes in, to fill any cloth moves, jewelry tinkles, etc. Lastly, if on set you have a prop with a particular sound, then look at sending that to the Foley team, just so they can get a match on sound—it certainly makes things a lot easier. Animation is a bit different, there's a much wider scope to play with sound, especially in a creature-type or magical-type film, whereas in live-action you can only go so far before it sounds ridiculous. I really enjoy animation, like the Lego films; I am currently doing Lego Batman, which is so much fun. (Simpson, 2016)

### **SOUND DESIGN EFFECTS**

While sound design effects (or elements/textures) are often defined as nonorganic, fabricated or as “special effects”, frequently the origin(s) are ordinary real-world, organic sounds, and/or a combination of the “real” and generated sound. Synthesizers are typically used for creating sci-fi sound effects, drones, pads and textures, and samplers for creating stylized sound design effects, but there are no hard and fast rules as to how a synthesizer or sampler is used. As illustrated by the online clip “Sound Design SFX & Textures (Chapter 4), these “special sounds” are not sound effects as

such, and often used to create a mood or enhance another soundtrack element, including sound effects, particularly within the science fiction and fantasy genres.

### **Synthesizer and Samplers**

A synthesizer is an electronic or a virtual instrument that uses oscillators and filters to create waveforms, which are processed to generate sound. Some synthesizers can closely reproduce the sound of musical instruments so can be used to create “organic”-sounding material. Synthesizers are controlled with a piano-style keyboard, called a MIDI (Musical Instrument Digital Interface) controller, which acts as an interface between the user and software. MIDI is an industry-standard protocol established in the early 1980s to enable electronic musical instruments to control, communicate, and synchronize with each other. MIDI does not transmit an actual audio signal; it transmits event messages such as pitch, intensity, and vibrato. Most DAWs are MIDI capable and come packaged with virtual instruments. MIDI can be integrated into sessions, edited alongside audio, and rerecorded as audio. There is a wide variety of virtual studio software and synthesizers, which use different technologies to generate an infinite number of new and unique sounds.

### **Subtractive and Additive Synthesis**

Subtractive synthesis in its most simplistic form consists of an oscillator (sound source) running through a filter, which is then sent to an amplifier and envelope (ADSR) control. The subtractive synthesizer was initially designed to mimic instruments, but then developed into its own “instrument.” The basic principle of subtractive synthesis is to start with a simple waveform (such as a square, triangle, or saw) generated by an oscillator, remove (subtract) certain frequencies with a filter, and manipulate the envelope response. The filter selectively removes certain harmonics or frequencies, altering the spectral content of the original waveform, and the envelope alters the “shape” of the waveform. Additive synthesis is similar except it “adds” instead of subtracting; multiple waves of varying levels and frequencies are combined to build different harmonic structures.

**Frequency Modulation Synthesis**

Frequency modulation (FM) synthesis employs a modulator oscillator that varies the frequency of a simple waveform, resulting in a more complex waveform and differing tones. FM synthesis is not effective at refabricating acoustic instruments and is generally used to create the more “synthetic” and electronic type of sound effects.

**Physical Modelling Synthesis**

Physical modelling synthesis uses algorithms to define the harmonic and acoustic characteristics of the sound being generated to simulate a more physical source of sound, usually a musical instrument. Synthesizers can be programmed to make distinctions between specific principles and design aspects of different instruments such as materials, size, and dimensions.

**Wavetable and Vector Synthesis**

Wavetable synthesis employs a table with various switchable frequencies played in certain orders (or wavetables). When a key is pressed, the sound moves smoothly in order through the wavetable, changing its shape into the various waves in the table. Wavetable synthesis is used for creating effects, textures, and pads. Vector synthesis employs the same method, except it uses a two-dimensional grid, which is considered smoother sounding.

**Phase Distortion Synthesis**

Phase distortion synthesizers are subtractive synthesizers that employ the waveform flexibility of wavetable synthesis in the oscillator, which allows for the control of waveforms between set shapes. The oscillator produces a periodic signal (sine, square, saw, triangle), and the fundamental frequency of the oscillator is determined by how fast the shape is repeated.

### **Granular Synthesis**

Granular synthesis works on the principles of wavetable synthesis and sampling, except on a micro-sound time scale. Instead of an oscillator providing the original waveform, sound samples (or fragments of sound) are used, which are split into small pieces of around 1 to 50 ms, called “grains.” Multiple grains can be layered and played at different speeds, phases, volume, and frequency. Granular synthesizers can create complex waveforms and are used to design sound effects, sound design elements, and textures.

### **Samplers and Sample-Based Synthesis**

A sampler is similar to a synthesizer, but instead of generating sounds, it uses audio recordings (or “samples”) of sounds that are loaded or recorded by the user and then played back by a keyboard, sequencer, or other triggering device. Most samplers have filters, modulation via low-frequency oscillation, and other processes to modify the sample in many different ways. Samples can be assigned to a keyboard in different zones and played back at different pitches/speeds. Samples can be anything from recordings of real instruments to sound effects. For example, a recording of a helicopter blade swooshing could be played back at a lower pitch and slower speed, and depending on the processing (reverb, flanger, etc.), could sound like the helicopter blades in *Apocalypse Now*. Real sounds can be altered and stylized to blur the line between “real” and “surreal.” Like with synthesizers, there is a variety of options, from simple apps to more complex programs.

These forms of synthesis are present in numerous different programs and full software programs that combine synthesizers, samplers, signal processors, sequencers, and mixers. Increasingly, synth apps and app versions of popular programs are being released, which is a cost-effective way of experimenting with different models. Packages such as Native Instruments Reaktor also allow users to custom design and build their own custom synths, samplers, effects, and sound design tools.



*Fig 5:5 Kontakt softsampler (Native Instruments)*

The options for creating sounds are endless, and in the same way that microphones are applicable to specific recording applications, there is not one option for all occasions. Real sounds are complex, and currently there isn't the technology to generate truly organic sounds. Overly synthesized sound effects tend to feel machinelike, artificial, and electronic, and therefore out of place in many film genres, aside from sci-fi. A laser is an obvious synth-generated effect, however synthesizers designed to emulate real instruments can be used to create interesting, unique, and organic-sounding sound and sound design textures. It boils down to selecting the right "source," tools, and process. A single bass guitar note, or a kick (acoustic or electronic) drum sample repeated, filtered, and effected, could provide the basis for "depicting" a pounding headache or serve as a texture to underscore and add tension to a scene. A wild recording of a jackhammer, equalized and played at a lower pitch,

could also provide a convincing alternative. Most of the sound design textures heard in contemporary films are a combination of real, generated, and processed sounds. Unlike sound effects, many sound design effects and textures are not sync dependent, which means they can be created during pre- production and production. On *A.I.* (Spielberg, 2001), sound designer Gary Rydstrom looked at design work to get a sense of what the cities, characters, and vehicles were going to look like. It's helpful for sound designers to get a sense of what might work for particular environments, moods, themes, scenes, props, and visual aesthetics, which can be via artwork, production stills, and footage from the shoot. This can spark ideas for recording and/or generating material as a 'start point' and "tooling up" in terms of sound design technology and processes.

## **DEVELOPMENT**

### **Spotting Sessions**

The traditional film "spotting" session entails the director and sound team getting together to watch a cut and decide where music and sound effects should be and why. During spotting sessions, SMPTE time code is used for identifying sound and image sync points, and the entry and exit points for music cues, which are all noted. Picture edits are typically exported with burned-in time code along with other materials such as effect cue sheets and edit decision lists (EDLs). Film spotting sessions are normally conducted after a rough cut and attended by the producer, director, supervising sound editor, sound designer(s), composer and sometimes the picture editor. Sometimes "physical" spotting sessions are not always possible or practical because work is undertaken in different countries or the director is tied up on other projects. In some situations, there are no sound effect spotting sessions; the sound designer(s) spot as they design, without any direction, and the director assesses the pre or final mix. In animation, spotting can occur in pre-production and throughout production. Earlier audio "sketches" are further developed, revised, and experimented with. Often there are alternatives; for example, a number of sound effects could work for a given visual



cue or effect. Sound designers/editors frequently leave “muted” material in a session and revisit alternatives prior to the final mix. Deciding what could be dropped or kept can be counter-productive, especially without a locked edit. On the other hand, too much material can cause mix problems.

### **Working with Animatics**

In animation, as production advances, animatics or works in progress (WIPs) are updated. Working with animatics means the soundtrack is being designed and revised alongside visuals, which helps with story, pacing, and shaping the rough cut. The first mixing task is the preparation of a temp soundtrack for audience test screenings and studio or client previews. This puts an additional demand on sound editors and designers to create at least the major effects and resolve any sound-image problems. Most directors are opposed to screening a film unless it has a relatively complete soundtrack. A temp mix is a preliminary mixing of dialogue, music, and sound effects, so that pre-vis, storyreels, animatics, and picture edits can be reviewed with all of these elements incorporated.

### **Shorts to Features**

In addition to using short films as medium for experimentation and learning, short films can provide a stepping stone to longer form works, if successful. *Harvie Krumpet* (Elliot, 2003), a surprising Academy win, at least for director Adam Elliot, utilizes Claymation to tell Harvie’s unfortunate biography. Elliot made his first short film, *Uncle* (Elliot, 1996), about an anonymous uncle, narrated by an anonymous nephew, while a student. His second film, *Cousin* (Elliot, 1998), explored the childhood relationship he had with his cousin, followed by *Brother* (Elliot, 1999), which explored childhood memories of his brother. As a writer, director, and animator, Elliot has a distinct storytelling style and an aesthetic approach that he’s carried through and developed in subsequent films.

*Harvie Krumpet*, a more complex and larger-budget short film, tells the story of a man cursed with bad luck. Born in Poland in 1922, Harvie is brought up by a lumberjack father and a lead-poisoned mother who works in a mine. Suffering from peculiarities and odd twitches, Harvie is diagnosed with Tourette's syndrome. The other children at school tease him, so his illiterate mother with a thing for "fakts" homeschools Harvie. The film contains a number of these "fakts" as Harvie carries on the tradition of gathering them. As he grows older, his mother gets crazier, often mistaking him for an intruder. Longing for change, Harvie discovers his house burned to the ground and his naked parents frozen to death on a bicycle. While attending their funeral, the Germans invade. Harvie flees to Australia, where he ends up living in suburbia with eleven other migrants. He gets a job at the local dump and tries to make friends, which results in a punch in the head from a co-worker. His skull is split in two, requiring a steel plate. After lint picking and selling pencils, he gets a job collecting golf balls and is struck by lightning. Harvie survives, but his habit of smoking twenty-eight cigarettes a day gives him asthma, and the plate in his head has turned him into a human magnet. While he is sitting in a park feeling sorry for himself, a statue of a Roman poet tells him to "seize the day." This strikes a chord with Harvie; he decides to stop believing in fate and start living. He joins a nudist group, becomes a vegetarian, and liberates chickens. Despite being enlightened, he loses a testicle, but meets Nurse Valerie and gets married. After Harvie is found sterile, they adopt a thalidomide girl they call Ruby. Harvie quits working to teach "fakts" to Ruby, who excels at school, becomes a lawyer, and moves to the USA to champion the rights of the disabled. On Harvie's sixty-fifth birthday, Valerie's brain clots and she dies. Harvie becomes a hermit and slips into senility. After trying to withdraw money from his microwave, he is sent to a nursing home for Alzheimer's patients. At the home, nudity is banned when Harvie is found naked and passed out on the floor after performing a drunken finger puppet show with his roommate. As Harvie's Alzheimer's gets worse, he slips in and out of dream worlds, most notably when the local church group visits. Suffering depression, he's put on Prozac, but missing Ruby, he decides to overdose on morphine

instead. During the suicide attempt, he meets another patient who does commit suicide, and Harvie decides to just enjoy the time he has left. He gets naked, sits in the nursing home's "pretend bus stop," and waits for a bus that will never come.

In 2005, *Harvie Krumpet* was named one of the top 100 animated films of all time by the Annecy Animation Festival board. The film's success helped Elliot create his first feature, *Mary and Max*, winning the award for Best Animated Feature at the Stuttgart Animation Festival, the Audience Award at the World Festival of Animated Film in Zagreb, and a shared Grand Crystal Best Feature Award with Henry Selick's *Coraline* (2009) at the Annecy International Animation Festival. The film tells the tale of an unlikely twenty-year friendship between pen pals—Mary, a lonely and odd eight-year-old girl living in the suburbs of Melbourne, and Max, a middle-aged, overweight man living in New York suffering from Asperger's syndrome. Mary is the only child of an alcoholic mother and a distracted father. One day at the post office, Mary decides to write to a person picked at random from one of the international phone books. She accidentally tears out a page during an incident with her "klepto" mother and later writes a letter to Max. Max is initially distraught by the letter but finds the courage to write back. Despite their differences, they share a lot in common: a love of chocolate and a TV show called *The Noblets*. As the exchange progresses, Mary's curious questions disturb Max, and his sporadic correspondence causes anxiety for Mary, who is growing up and experiencing her own problems. As she learns more about Max's condition, she decides to study psychology at college and writes a book on Asperger's. When she sends Max an advanced copy, feeling betrayed, he loses it and sends her the typewriter key for the letter "M," which causes Mary to lose it. She shreds all the book copies and sends him a can of condensed milk, her favorite food, as an apology. Max eventually overcomes his anger and writes back to Mary. He sends her his entire collection of Noblet figures to say he's forgiven her. The gift prevents the distraught and now-pregnant Mary from hanging herself. Later, with her new baby, she travels to New York and finds Max leaning back on his sofa, having just passed

away. As she sits beside him, following his gaze, she sees that Max had pasted her letters all over his ceiling.

The film involved more than 200 puppets, 130 sets, and nearly 500 miniature props. A larger budget allowed for a bigger team and higher production values. In keeping with Elliot's previous works, narration drives the story, with sync dialogue, sound design, and music. The sound design is often subtle: Saturday afternoon suburban atmos, contrasting with the more prominent New York City sounds, gunshots included. Music further supports the two differing environments, drives key emotive scenes, and supports the comical events. However bleak the storyline, it's loaded with comic moments that could almost be missed if they weren't punctuated with sound effects. There's Grand Poppy Ralph's erect nipples, the counting of sheep, babies in the bottom of beer glasses, and the wobbly mother who bakes drunk mistaking the dishwasher for the oven. Sound draws the eye, enhancing visual details, character traits, and the two differing environments the lead characters inhabit.

Elliot's most recent film, *Ernie Biscuit* (2015), explores the life of a deaf Parisian taxidermist and marks a return to short form. As an independent filmmaker and someone intent on telling his own stories, in his own way, Elliot has also used *Ernie Biscuit* as a vehicle for exploring new technology and ways of reducing production costs in preparation for his next independent feature film.

*Uncle* (1996), *Cousin* (1999), and *Brother* (2000) are very minimal with the sound. They were also shot on film and sound was done the old-fashioned analogue way. You didn't have the luxury of complex soundtracks, but now you do; with computers, you can have many tracks and hundreds of layers. Right from day one I've always known that sound is crucial. As my films are driven by narration, it's important to have very good voice recordings, particularly with my first three

films, because there's no music at all. The narration is what's driving the film. I agree with criticism about the use of narration: it's often seen as a lazy way of telling a story, and it certainly can be, but I've always argued that my budgets don't allow for a lot of lip-sync. Stop-motion animation is incredibly slow and therefore expensive to do, so having a narrator saves money. I also love the anonymous narrator, guiding and telling you what's happening. There's something very intimate about narration that I've always loved. There's that quote, "Don't say it, show it," and I always apply that principle when I'm writing and doing the storyboard. I try to keep my narration to an absolute minimum and pair it right back. The award for *Harvie Krumpet* was unexpected. I was just glad when it was completed. We didn't have very high expectations. It's a very long short—festivals hate long shorts—it doesn't have a plot, and it's quite linear. So Melanie and I were shocked when it happened, but then quickly realized that an Oscar was going to allow us to make a feature film.

I do a lot of drafts of the screenplay and once that's locked off I hand-draw all my own storyboards. I've never employed a storyboard artist. I've only ever had one animatic and that was on *Mary and Max*, because it was a feature and there was so many other people I had to work with. It was easier to have an animatic. My storyboards were scanned and then put into an Avid. They weren't overly complex, but the good thing about having an animatic was being able to insert the music very early on in preproduction. It helped the animators understand why I was using certain pieces of music and how crucial they were. I often choose music at script stage and it's the impetus for a certain scene or moment. So music often comes first, even before the characters. I'm writing a new screenplay at the moment and the

whole film has a signature piece of music I chose even before I came up with plot. Music in my later career has actually become a wonderful way of conveying emotion, mood, humor, and pathos. That's why I use a lot of very emotive classical music juxtaposed with quirky, cheesy music. It's a bit of a smorgasbord of styles and varieties. I was lucky on *Mary and Max* because we had \$8,000,000. My producer Melanie said go nuts and choose whatever pieces you want, so I did, but once we started to investigate how much it was going to cost, we were quite shocked. A lot of the cheesy music I'd chosen was actually quite expensive because it was used in advertising, for jingles. There was a lot of negotiation and begging, and it still went into the hundreds and thousands of dollars for licensing. We also had a composer and an orchestra, so that became quite expensive as well.

Peter Walker, the sound mixer, was great. He was fantastic because he was more of a perfectionist than I was, and always reminded me of how important the sound was. He spent a lot of time getting the sound right on Harvie Krumpet and I don't think he's been given enough credit for that over the years. Most of the music was from CDs, and we didn't have a composer, so he wasn't given a lot to play with, but we did put a lot of effort into Foley. It is a shame, because my films are narrated and the narration often wins, so the music and effects have to be pulled down. Just like a lot of shots and scenes end up on the cutting room floor, so does a lot of fantastic sound. On *Mary and Max* I also had a wonderful film editor, Bill Murphy—he was just as much of a perfectionist as Peter Walker was. The edits to all my films have taken weeks and weeks and weeks, and months for *Mary and Max* because of that very fact, the narration was always competing with all

the other elements. So it was very manicured, extremely slow, and therefore expensive to get it all balanced.

*Ernie Biscuit* is more of an experimental short to test out new types of software and plasticine. We realized after *Mary and Max* that \$8,000,000 was a luxury, so we had to work out ways of getting our budgets down, particularly as we want to keep making art house independent films. I certainly never want to make a high-end kids' film—not that there's anything wrong with that, but my films are for adults. So we realized that we had to come up with new ways of making films, in a cost-effective manner, and that was what *Ernie Biscuit* was primarily about. Surprisingly, it's doing quite well for a film that was extremely low budget. In regards to the sound, I did most of it myself. That's always dangerous, when you try and do everything yourself, particularly sound, because it's such a specialized component of making a film. You should never edit your own film, and I think I'll add to that, you should never do all your own sound. I had a wonderful sound mixer, but as I self-financed *Ernie Biscuit* I couldn't afford hundreds and thousands of dollars to employ a team of sound designers. I think more than ever I've realized the importance of a good soundscape. In an ideal world, I would continue to employ John Simpson, who does incredible Foley. We had him on *Mary and Max* and he's a genius. Having said that, I have done my own Foley, I've now downloaded Foley, so there are always ways. You have to think laterally; there's a lot of compromise, as with any low-budget film. I love Foley and will always go for something real and authentic over something that comes from a library, but they are a cheap and efficient way of gathering material. I think the danger for animation is, if you go for cartoony sound effects, unless that's what you're aiming to do, to make a cartoon animation, it's *doinks* and *dings*, and I hate all that.

For me it's about creating authenticity and believable characters. Ultimately, I'm trying to convince the audience that these lumps of clay are real people, so when they die you are genuinely affected and moved. The last thing you want is your soundtrack to sound clinical or fake. You need to put as much effort into sound as into vision. There's a piece of music from *Eye Level*, a 1972 single by the Simon Park Orchestra, used in a Dutch detective series. I just had to have that piece of music. It's also the intro to the film and the credit film. It's a very cheesy, upbeat, '70s instrumental, and I quickly discovered that it was also expensive. I had to decide whether I was going to go with it and sacrifice a lot of the money that I had saved for the film. It cost thousands of dollars to license and I had to negotiate heavily for it, but without that music I think the film would suffer. I just had to have it. I also had Tchaikovsky's 1812 Overture, but luckily he's dead, so that's a lot cheaper. The luxury with *Harvie Krumpet* was we had \$300,000 so could proportion a lot of that to sound. On *Ernie Biscuit* I had to do all that myself. I managed to do it, and it works for this film, but it certainly doesn't have the layered richness that *Mary and Max* and *Harvie Krumpet* had.

There's an assumption sound happens in post—it's an afterthought. It's very dangerous to just approach sound when you're sitting in the edit suite. Talk to a sound designer early on and start planning at the storyboard stage. We have the luxury of creating very dynamic soundtracks if we chose, with time and money. Give your sound mixer lots to play with, just as you would give your editor lots to play with. Strive for authenticity and try to be a lateral thinker. If you can't afford a certain piece of music, don't be scared to negotiate or find something



similar. Always get a good sound mixer; don't attempt to sound mix yourself. Budgeting is a tough one. It really comes down to what sort of story you've written. It also depends on the scene, but sound is just as important as the visuals. With any short film or independent feature film, there's always budget constraints. The mistake a lot of filmmakers make is that they don't put enough emphasis and money into the sound. They'll have very high-resolution images, but they think high production values are just visual. To me that's also the sound. I worry that a lot of emerging filmmakers are obsessed with the look of their films, and sound and story is secondary. For me the story is always paramount, and then of course I want my films to look and sound as beautiful as possible. (Elliot, 2016)



*Fig 5:6 Mary and Max (Elliot 2009), Adam Elliot Clayographies and Melodrama Pictures*

In summary, having the right personnel, talent, facilities, and tools is important, as is preparation. A supervising sound editor or sound designer should have access to a script well before production begins to ensure all audio requirements are identified, so that they can be planned and budgeted for in advance. In live action, the production

focus is on the shoot, capturing quality dialogue, room tone, atmos, wild tracks, and other effects where appropriate. If the script involves any unique sounds, props, or specific vehicles, make sure they are also recorded (wild); they will probably be more authentic and of a higher quality than the material found in most sound libraries. In animation, by the end of production, the soundtrack should be relatively well conceptualized. When hearing sound with pictures, dramatic opportunities and dynamic moments are easier to realize. Being selective and story focused also helps streamline the post-production process; the mix should be taken into account and planned for during pre-production and production. As previously discussed, poor quality recordings have a detrimental effect on a soundtrack. While there are audio repair plug-ins, there are no “silver bullets”, and most problems occur due to a lack of understanding, or a lack of “preparedness” when it comes to capturing, creating and managing sound through production and postproduction processes.

### **Snow Country for Cold Elves – Short Film/48 Hours Film Competition (online)**

HP48HOURS is NZ's largest guerrilla filmmaking competition and is held in most cities around the world. Filmmakers do not know what genre (thriller/romance etc.) they will be shooting until the start of the competition. The film must be written and completed within a 48-hour window, beginning Friday evening at 7 pm and ending Sunday at 7 pm. Filmmakers must also include specific elements such as a specific line of dialogue, props, characters and production techniques. Creating a short film in 48 hours is by and large an exercise in speed, resourcefulness and collaboration, and it is especially difficult for filmmakers to get to and through audio postproduction in such a short timeframe. I recommend it to all film and sound students because it has forced me, and will force them to really think about workflow.



*Fig 5:7 Snow Country for Cold Elves (dir. Ow & Maramara  
2007*

For the 2017 event teams had to include a female character, a collision, a smash cut and a Wilhelm scream sound effect. The team I was involved with got the genre of *Christmas Movie* and theme of *Justice*. On *Snow Country for Cold Elves* around 8-10 hours was spent on creating and mixing the soundtrack; adding foley, sound and sound design effects, including the required Wilhelm scream sound effect. The film is largely narration driven, with some sync dialogue, which meant the soundtrack was going to mixed in certain way, the narration would drive the mix and everything else would need to “wrap” around the narration.

The film opens with the title and VFX of snow (blustery and cold wind), followed by an exterior “shot” of the elves workshop in the North Pole. The following scene in an interior of the workshop whereby Santa is driving his elf workers hard, they’re knitting “wool mitts” and reading letters from children. One of the elves receives a letter from a child suggesting she come to New Zealand for a holiday. The elf, wanting to escape from slave-driving Santa decides to flee. Santa, noticing the absence pulls his machine gun off the wall and pursues her. The following scene depicts the deranged Santa stalking the fleeing elf through the forest. Eventually the elf arrives in New Zealand,

at the home of the child who wrote her the letter, but before she gets to knock on the door Santa appears and a fight unfolds. The elf suffers a beating which is interrupted by the child and a friend. They too get attacked by Santa until the elf recovers enough to kick Santa (cue Wilhelm scream) and then with his gun “pop a cap in his arse”.

To add an extra degree of challenge to the challenge, I was in the USA and everyone else was in New Zealand. The online example shows what I was delivered to start with and the final result, although flawed it illustrates how important collaboration is. While the mix was essentially “pre-shaped” because of narration, it “work” it required additional dialogue, Santa “mumbling abrasively” in the workshop, which was supplied by a “sound assistant” in New Zealand. The film also required a lot of foley, and cutting pre-existing material to “fit” with image tends to be slower than performing to image. So, the knitting needles are drum sticks, and the letter opening is a piece of paper, more obvious than drum sticks, but faced with a very tight deadline resourcefulness is everything. All other foley and sound effects were from sound effect libraries and re-worked. One of the most important aspects to actually delivering a mix on time was collaboration with the composer. The scene where Santa is stalking the elf in the forest is driven by music and lyrics, which was being worked on at the same time as sound. I was delivered a temp track early on, which meant sound only needed to cover atmos and key foley for that scene. Collaboration between sound designers and composers is an area that the industry struggles with. They are different departments, different processes and different “mind steps”, but when it comes to outputting a mix it helps to know what each department is doing, before they deliver.

## **CHAPTER 6: POSTPRODUCTION**

Postproduction is considered the final stage of creating a film, encompassing many different processes: picture editing, VFX, grading, music composition, ADR, sound editing, design, mixing, and mastering. The majority of work undertaken in audio postproduction is sound editing and design, followed by premixing and the final mix. Soundtracks are mixed, mastered, and encoded relative to the project's distribution and release model: Web, broadcast, DVD, and cinema. Since the late 1990s, animated, CGI, and VFX-heavy films have dominated mainstream cinema, which has altered approaches to film production. Pre-visualization techniques have gained wider acceptance across the media and entertainment industries. Cameras that capture 3D volume information are also being designed to make it easier to integrate live action with CGI, and cinematic VR has become a reality. Animation, digital migration, and emerging technologies are essentially redefining conventional film production processes and blurring the lines between mediums and production stages. Some practitioners maintain that a film is created in postproduction because of the impact of picture editing has, however the general trend is greater consideration of postproduction in and through preproduction.

### **SOUND AND PICTURE EDITING**

Postproduction supervisors are responsible for managing postproduction and maintaining good channels of communication between the producer, editor, supervising sound editor (or sound designer, audio director), external facilities, and the production accountant. The complexity varies according to the type of project and budget. On low-budget projects and shorts, the producer or director may take on the role. On animated films and feature films incorporating CGI, the post-production supervisor is usually involved during preproduction and throughout production. In games production, the role of narrative designer is evolving, which incorporates assembling prototype story components such as storyboards and animatics; working

with animators, artists, editors, designers, and programmers; and liaising with the sound department throughout the production phase. The increasing popularity of pre-visualization processes has introduced the role of “pre-vis editor,” someone who edits animated QuickTime movies and is responsible for recording temporary dialogue and editing sound effects and music.

Traditional live-action film postproduction starts with the logging/ingestion of dailies (daily raw footage shot during the production of a film) or rushes, followed by the first assembly and a rough cut, a first cut, a fine cut, and a final cut. Edit changes make finalizing sound and music difficult, which results in delays and budget issues. Conversely, it’s difficult to lock a picture edit without sound. There are various ways of handling picture changes across departments. The picture editor can supply a new OMF/AAF export or a new QuickTime with guide audio for smaller manual revisions. Applications such as EdiLoad allow editors to conform location .WAV files in a DAW such as Pro Tools, and re-conform after any picture edit revisions. Conforming (or assembly), is the process of enforcing the edits made by the picture editor using a guide audio track. There are a few different applications for both conforming and re-conforming, which work in much the same way. “VirtualKaty” was developed during the postproduction of *Lord of the Rings* to handle numerous picture edit changes; it compares the differences between EDLs on completion of a new cut. The picture editor exports an EDL from Avid to the sound department, which VirtualKaty compares with the previous version and updates Pro Tools sessions to reflect any changes. These types of tools and processes are important for large-scale productions such as feature films and fast turnaround projects like television series.

In live-action films, there are usually several takes and angles to select from, whereas an animated film is largely “pre-edited”—the editor usually starts working with the director and/or story supervisor once the script and storyboards are finished. Story reels set up the timing of the film before animation begins. The editor times sequences, and in collaboration with the sound department, adds or replaces dialogue, temporary

SFX, and music. The edit is updated and revised as shots progress, from rough animation to the final render, composite, and output. The differences between a story reel and the final edit of an animated film can be marginal, whereas in live action the film editor cuts the film based on available footage, which means a film can change quite dramatically during the editing stage. After test screenings are conducted, a cut is then finessed unless there is a need for additional shots or major changes. Once revised, a film is said to be “picture locked,” which means no more edit changes are to be made. However, the ease of making changes in nonlinear editing systems has resulted in picture changes being made right up to the final mix stage.

### **Editing Theories**

Picture editing, like sound, is another film craft that’s often underappreciated, largely because the work involved goes unnoticed. Editing is often called “the invisible art” because a good editor will make a film feel so seamless the audience will not be aware of the editing. The “finer” the technique, the less noticeable the editors contribution to a film (Dmytryk, 2019). In more recent times picture editors has gained more recognition. The American Cinema Editors Association now presents an annual “Invisible Art, Visible Artists” panel to highlight the work of picture editors. Walter Murch defines the ideal picture edit as adhering to six priorities: It’s true to the emotion of any given moment, it advances the story, and it works rhythmically. Secondary is the consideration of “eye trace” (where the audience is looking), 2D place, and 3D space, which concerns the coherency and cohesion in placement and movement of people in places and in relation to one another. Both sound design and mixing recognize similar guidelines: the selection and creation of sounds, the relationship between sounds, the perspective of sounds relative to and situated in a given plane, and the relationship between sound and image. The sound design needs to suit the narrative and become part of the film’s aesthetic.

You have more freedom with sound than you do with picture. There are, consequently, fewer rules. But the big three things—which are

emotion, story, and rhythm—apply to sound just as much as they apply to picture. You are always primarily looking for something that will underline or emphasize or counterpoint the emotion that you want to elicit from the audience. You can do that through sound just as well as through editing, if not more so. Rhythm is obviously important; sound is a temporal medium. And then story. You choose sounds that help people to feel the story of what you're doing. (Murch in Jarrett, n.d.)

Both picture editing and sound are concerned with timing, pacing, and rhythm. The pacing of an edit is determined by a combination of kinetic qualities: the length of shots, the rhythm of editing, the number of cuts, connections between edits, and the relationship between sound and the visuals. The way a film is edited influences soundtrack design and in turn, sound influences the picture edit. Sound can smooth or accentuate edits and slow down or accelerate the pacing of a scene. There are no hard and fast rules as to how a film is cut or how sound is designed or mixed, but there are some basic principles to keep in mind. Some sounds are difficult to understand without an initial visual reference for support, and audiences need a period of time to hear and register certain sounds. Too much sound, too quickly, makes it difficult for an audience to “focus,” especially when there's also a lot of visual detail and/or fast cutting. Having an understanding of how shots are assembled and how an edit will affect sound and vice versa is invaluable when it comes to conceptualizing a film. Typically, most commercial films and television or Web series are dialogue driven and cut in consideration of the dialogue, although different editors employ different ways of working. During the first assembly of a film, Walter Murch turns off the dialogue and any production sound to focus on the visuals. This makes him pay more attention to sound and the possibilities for sound design, which helps generate sound ideas. As an edit progresses, Murch adds sound and assesses the impact on visuals. By not focusing on dialogue and production sound, the film is acquiring shape while welcoming the influence of sound. Like many film editors, Murch also avoids too



much focus on music until the picture edit feels complete. Music is treated with restraint and primarily used to underscore and support the emotion that's in the images. In the lead-up to any test screenings, he prepares the edit with sound so that the film feels as finished as possible. While he may not always formally take on the role of sound designer, he's affecting the design and mix direction through editing with sound.

My heart aches for people who work the other way because they have to start from a dead stop. They have to come up to speed not having really any idea of what is going to happen. And the bad thing that happens is everything gets put in and, as a result, you get a logjam of sound at the mix that frequently results in a kind of conceptual muddiness...and this I think is related to some general criticisms of films being too loud. Because it is so dense, the ear can't make any sense out of it, so the director asks to increase the level. The mixers make it louder, and you quickly arrive at the threshold at which you can endure it, hoping for some kind of clarity to emerge from the loudness. But it's the clarity of the mallet on the head, and what an audience hears is noise. Because it's conceptually muddy, they can't begin to separate out what they're supposed to hear. And when they don't know what they're supposed to hear, their threshold of where loudness begins is much lower. (Murch in Kenny, 2000)

### **Evolution of the Invisible Arts**

The first films consisted of one shot, so there was no editing. Edwin S. Porter pioneered the use of dramatic editing in the early 1900s. Porter's *The Great Train Robbery* (1903) was ground breaking at the time and considered the first narrative film to achieve continuity of action. D. W. Griffith was after credited as the inventor of modern editing and establishing the basic grammar of film editing. His 1916 film *Intolerance* is considered a landmark in cinematic history largely due to the film's

nonlinear plot structure, which consists of four separate yet parallel stories spanning 2,500 years.

*Intolerance* also initiated an examination into the impact of film editing by Soviet filmmaker Lev Kuleshov. Kuleshov was among the first to experiment with the effect of juxtaposition, which evolved into what became known as the theory of montage or Soviet montage theory. Kuleshov cut a shot of an expressionless actor with shots of three different subjects, a girl in a coffin, a hot plate of soup, and a woman. Audiences perceived the actor's performance differently relative to the different shots. At first he looked sad, then hungry, then lustful. Kuleshov discovered that depending on how shots are assembled, audiences attach a specific meaning or emotion to the shot, and he concluded that the essence of cinema is in the way a film is edited.



*Fig 6:1 Intolerance: Love's Struggle throughout the Ages (1916, dir. D. W. Griffith), Triangle Film Corporation, Wark Producing*

Sergi Eisenstein adopted and expanded on montage theory, believing that multiple images edited together created a “tertium quid,” which is Latin for “a third thing” and refers to an unidentified third element, which is greater than its individual parts. The phrase is associated with alchemy, a form of chemistry and philosophy practiced in the Middle Ages and Renaissance period. A general use of the word is to describe a process that transforms a common substance into a substance of greater value. Eisenstein’s *Battleship Potempkin* (1925) is hailed as a classic example of experimentation with the montage. Images of marching soldiers are cut with fleeing citizens to incite a feeling of helplessness, and then oppression as soldiers are seen

firing on the crowd. In *Strike* (1925), Eisenstein included a sequence that cuts between the slaughter of a bull, and police attacking workers, drawing a metaphorical connection between an assault on workers and a slaughtered bull. A well-known example is *2001: A Space Odyssey* (Kubrick, 1968). An ape beats another ape using a bone as a weapon for the first time. He tosses the bone into the air, which cuts to a satellite in space, depicting years of human evolution in two shots. The cut draws a connection between the two objects, bone and satellite, primitive and advanced tools, quickly summarizing humanity's technological advancements.

After the introduction of sound, both Kuleshov and Eisenstein started to explore sound in a similar way to their experimentation with pictures. Sound or sound montages achieve the same effect as the visual montage, albeit more subconsciously. Sound can support and enhance the idea behind a visual arrangement or create an idea of its own in the mind of the viewer/listener. In his book *On Directing Film* (1991), David Mamet describes how filmmakers take unrelated shots and juxtapose them to convey an idea. Mamet uses the example of cutting two shots that have nothing to do with each other, a bird snapping a twig and a fawn raising his head. The combining of the two images gives the viewer the idea of alertness and/or danger. Imagine these two shots as mute, without sound, and then imagine them with sound. The sound of a twig snapping would give the viewer/listener the idea of alertness. A distant gunshot would give the viewer/listener the idea of danger. The sound of a gunshot would also tell the audience how close or far away the potential danger is and give some clues as to what it is—a hunter, perhaps? The gunshot could also be replaced with any number of sounds, each of which would tell the audience something beyond what they're seeing and hearing. Audiences make connections between seemingly unrelated images and sounds, which gives filmmakers an extensive tool kit when it comes to creating meaning and emotion—a fourth dimension.

The advent of sound in the 1930s expanded and complicated the film editor's role. There were two mediums to be cut and then synchronized. Directors were rarely involved in the process, which was controlled by the studios and their supervising editors. Editors were called "cutters" and viewed as highly skilled mechanics. MGM's Margaret Booth mastered the transition to sound and became known as one of the first film editors. Booth is acknowledged for introducing the concept of cutting for emotion and initiating a shift in perceptions. Editing evolved from being seen as "mechanical" to being understood as a creative and editorial discipline. Until the 1950s, film editing was largely formulaic; scenes opened with establishing shots that cut to medium shots and close-ups. Dissolves and fades were frequently used to signal changes in time and place. Film editor Dede Allen rejected formula and introduced new techniques such as making sound precede picture (or pre-lapping), rapid cutting, using slow motion, cutting before the end of the scene, and altering time by changing the sequence of scenes. Allen was also the first film editor to receive a solo opening credit on *Bonnie and Clyde* (Penn, 1967). Thelma Schoonmaker is another widely regarded film editor and has worked on all of Martin Scorsese's films since *Raging Bull* (Scorsese, 1980). She has received seven Academy Award nominations for Best Film Editing, winning an award for *Raging Bull* (Scorsese, 1980), *The Aviator* (Scorsese, 2004), and *The Departed* (Scorsese, 2006). One of Schoonmaker's techniques is to cut alternative versions of a scene, one that she feels matches Scorsese's vision and variations if she thinks there are better or different ways of editing a scene. A scene can be shot or animated different ways, it can also be edited, sound designed and mixed in a number of different ways. It's difficult to gauge the impact of different approaches without experimentation.

### **Montage and Continuity**

All films are edited, but the most successful films use a variety of editing techniques to tell and enhance the storytelling. There are two main approaches to editing, montage and continuity. Continuity situates editing as the driving force of narrative films but

adheres more to the script, whereas montage is more concerned with associations between shots and is more commonly employed as an emotive, dramatic, and aesthetic- narrative device. Montages in contemporary films also build upon the same principle developed in early film: a series of images that condense time and story. Continuity editing is about invisibility. A film feels seamless when the audience is focused on the story, not the production. The key considerations in continuity editing are screen direction, eye lines, and adhering to the 180-degree rule so that action unfolds with spatiotemporal consistency and smooth transitions of time and space. Disorienting an audience pulls them out of the story. Editors create sequences that flow, as if everything is happening continuously, unless for effect. In *The Lord of the Rings: The Two Towers* (Jackson, 2002), the rules are broken to make a “conversation” between Gollum and Sméagol feel like it’s occurring between two different characters (the good and the bad). The sequence starts with the camera panning the line, so the audience becomes aware they’re watching one character having a schizophrenic conversation. The scene is dialogue driven, with forest atmos constant across picture edits. Music underscores the taunting of the tortured Sméagol, which fades in after Gollum calls Sméagol a “murderer,” increasing in intensity as Sméagol demands that Gollum leave, and then dropping out completely as Sméagol realizes he’s been talking to his evil self.



*Fig 6:2 The Lord of the Rings: The Two Towers (2002, dir. Peter Jackson), New Line Cinema, WingNut Films*

Sound is often used to bridge cuts or transitions between shots and scenes, which is sometimes written into the script. Continuing sound across a shot transition can smooth an edit and reinforce a sense of narrative continuity, which helps sustain the illusion that events are taking place in a continuous space or time. Sound and picture cuts are often staggered and known as a “split edit.” When the sound of the next shot or scene is introduced before the next shot, it can set up a sense of anticipation. On the other hand, cutting or fading a shot and sound simultaneously emphasizes the edit, which is common in location, time, and scene changes. In continuity editing, shots are commonly cut together on an action, but if the action isn’t “matched,” sound can exaggerate the cut. If someone is closing a door and the action is not seamless across the edit, the sound either doubles up (the door closes twice), or there is something unnatural about the sound/cut (because the door is closing, and then it’s closed). In

live-action films, issues like this are apparent. In animation, problematic edits can sometimes be “cheated” with sound; a continuous sound can fool the eye into seeing continuous movement. At times, it’s preferable to allow moving objects to leave or enter the frame and cut after or before an action. This technique can also allow for greater use of sound and sound-image arrangements. For example, someone walking into a frame can be heard prior to being seen. We could hear the sound of heavy combat boots on gravel walking slowly, which would “subconsciously” tell the audience something about the location, character (soldier, military?), and possibly intent (uncertain, confident, measured?).

### **Creative Editing Techniques**

Narrative films are complex; they involve internal states, psychological or emotional, which are not necessarily “seen” or expressed in dialogue. Following are a number of relational concepts that underpin creative sound and picture editing used for narrative, aesthetic, and emotive effect:

#### **Graphic-Sonic**

Interest, emotional engagement, and meaning can be created by graphical information (shape, color, composition, and treatment) and/or aural information (shape/envelope, color/timbre, composition/frequency, and treatment), which is similar when cutting from one shot to another. In *The 39 Steps* (Hitchcock, 1935), a shot of a woman screaming cuts to a shot of a train sounding its whistle. In *Psycho* (Hitchcock, 1960), the shower scene ends with the camera tracking blood and water as they flow down the bathtub sinkhole, which dissolves into a match cut of Marion’s eye. The sound of the shower still running overlaps the match cut, which tracks out, revealing Marion dead on the floor, before cutting to a shot of the showerhead. In *Apocalypse Now* (Coppola, 1979), the sound design and imagery connect the ceiling fan with helicopter blades and to war and Willard’s emotional state.



### **Aural-Visual Rhythms**

Movement within a shot can be used to set the tempo of an edit, which can also extend to sound associated with, or attached to, that movement. Camera movement, character performance, dialogue, sound design, and music all embody and define rhythm, and therefore can determine the tempo and pacing of an edit, either separately or as combinations. *Delicatessen* (Jeunet & Caro, 1991) is an example of using aural-visual rhythms and creative sound design to connect characters within an environment. The film is set in a run-down apartment building owned by a butcher. The building is in constant need of a handyman, because the butcher routinely butchers them to sell as food to the apartment's kooky occupants. Food is so scarce it's used as a form of currency. Louison, a former clown desperate for work, applies for the job of handyman and forms a relationship with the butcher's daughter, Julie. Julie and a team of underground vegetarian rebels save Louison from the meat cleaver. The film takes place in, on, around, and underneath the delicatessen and uses an old heating pipe running through the building to connect characters and the storyline. The opening sequence sets up the narrative and aesthetic of the film with the butcher sharpening his tools. The sound (and camera) travel through the pipe to a room upstairs, where a terrified tenant is wrapping himself in newspaper. He hides in a dustbin in an unsuccessful attempt to escape the butcher. Later the other tenants are introduced through connecting sound and image. An amorous butcher sets off the sequence with bedsprings squeaking rhythmically, while his daughter is practicing the cello, a woman slaps the dust from a rug, another tenant is pumping up a bicycle wheel, an elderly woman knits, a metronome ticks, two men make and test novelty sheep "baaing" toys, and the clown is painting the ceiling. The intercutting and sound get faster and faster until the sequence climaxes and concludes with the tire popping, a cello string breaking, and Louison falling off his ladder.



*Fig 6:3 Delicatessen (1991, dir. Marc Caro, Jean- Pierre Jeunet), Constellation, Union Générale Cinématographique (UGC), Hachette Première*

### Temporal Manipulations

Film is the manipulation of time. Time is expanded (slowed down), for example in a slow-motion fight scene. More commonly time is compressed, and the story takes place over a longer time period than the duration of the film. Elliptical editing is the technique used in film editing to reduce the duration of an event. Flashbacks/forwards are also common manipulations of time and can be objective, from an “observer’s”

point of view, so the audience feels as if they are in the scene, but somewhat removed, or subjective, which gives an audience the illusion that they are the character in the scene. Flashbacks/forwards are often initiated by sound; sometimes a reoccurring design effect signifies a shift in time for the audience, or a sound effect acts a memory and triggers a flashback/forward. Most flashbacks/forwards include changes in visual and aural treatment, dissolves, and fades and are sometimes superimposed text with sound effects. Flashbacks/forwards are a narrative device that offers character insights and helps advance the story. In *The Sixth Sense* (Shyamalan, 1999), psychologist Dr. Malcolm Crowe (Bruce Willis) attempts to uncover the truth about a young boy's (Cole) supernatural abilities. Through flashbacks, he re-experiences earlier conversations and realizes that he is dead. In *The Jacket* (Maybury, 2005), Jack Starks, a Gulf War veteran, is accused of murder and incarcerated in a mental institution. Starks is forced to undergo an unauthorized treatment with experimental drugs. Bound in a straitjacket and placed inside a morgue drawer as a form of sensory deprivation, he is somehow able to travel fifteen years into the future for short periods of time. The flash forwards are visually and aurally stylized, fragments and flashes of sound and image.



*Fig 6:4 The Jacket (2005, dir. John Maybury), Mandalay Pictures, Warner Independent Pictures (WIP), 2929 Productions*

### **Themes and Subtext**

In thematic editing, images are cut together based on a central theme to communicate feelings or experiences. Montages are often thematic. Cross-cutting (or parallel editing) is another common method of editing in which the POV (point of view) switches alternately from events at one location to those of another. The action is usually simultaneous and creates dynamic tension, or the “third thing,” which is often thematic. The baptism scene in *The Godfather* (Coppola, 1972) is a well-known

example of parallel cutting. Michael Corleone and his nephew are seen getting baptized, while leaders of five rival families are being murdered. The juxtaposition of violence with baptism, birth, and death, emphasizes Michael's transition from the Marine who initially shunned the family business to a mobster and then Godfather. He orders the murders, which seals his transition, and re-establishes the Corleones as the nation's most powerful crime family. The scene starts in the church, with organ music and the sound of the baby crying. As the scene unfolds, the organ music bridges the action, creating a tension between the baptism and the murders. The organ music and dialogue from the priest performing the baptism drive the scene, while the baby crying is heard out of visual context. The reality and "grittiness" of the murders is set up through the use of Foley (guns, footsteps, cracking of glasses), sound effects (gunshots), and screams from the victims, juxtaposed with Michael calmly renouncing Satan as his enemies are eradicated.

### **Dreams and Nightmares**

Dream and nightmare sequences in films are often used to give the audience insight into a character's mindset, usually in reflection of a conflict or fear the character is facing, which advances the narrative. The use of symbolism and metaphors is common, as is the stylized treatment of both sound and image. In the case of horror films, dreams and nightmares are often central to the narrative. In *Nightmare on Elm Street* (Craven, 1984), college students experience nightmares involving a figure with razor-sharp "finger knives," and they realize they have to stay awake to keep alive. *Waking Life* (Linklater, 2001) explores a range of philosophical questions, including the nature of reality, dreams, consciousness, and the meaning of life, through the central character, who wanders through a succession of dreamlike realities. The entire plot of *Inception* (Nolan, 2010) is based on dreams, as a thief, Dominic "Dom" Cobb, uses dream-sharing technology to steal corporate secrets. Dom and his team of "extractors" use experimental military technology to infiltrate the subconscious of their targets and extract information through a shared dream world. Dom is then

contracted to do the reverse and plant an idea in the mind of a CEO. Most of the film takes place in these interconnected multilevel dream worlds, which sound reflects by combining literal, nonliteral, and sub-textural sound. Sometimes when people are dreaming, external sound is incorporated into the dream. Walter Murch explored this in the opening scene from *Apocalypse Now*. At first the helicopter is a more abstract electronic sound, but then it becomes the sound of a real helicopter as Willard wakes from his jungle dream into the reality of the hotel room. When he opens his eyes, he thinks the helicopter sound is coming from the ceiling fan until he realizes that the sound is a real helicopter flying over the hotel. The intention of the effect is to mimic the disorientation that happens when dreaming; a sound from the real world enters the dream and is incorporated into the dream reality. According to psychologists, 10 to 20 percent of people also experience “exploding head syndrome,” which is hearing a sound that can’t be explained. People are woken by an abrupt imaginary sound, ranging from explosions and fireworks to slammed doors, the sound of a gun firing, an enormous roar, shouting, thunder, or a crack of lightning. Doctors suspect it stems from problems with the brain shutting down; instead of shutting down properly, the brain cells responsible for sound fire at once, creating a blast of energy that the brain interprets as a loud sound. Dreams and nightmares are mysterious occurrences and so open the door for interesting approaches to both sound and visual design.



*Fig 6:5 Inception (2010, dir. Christopher Nolan), Warner Bros., Legendary Entertainment, Syncopy*

### **Jump Cuts**

A jump cut occurs when two sequential shots of the same subject are taken from positions that vary only slightly. The effect can be jarring and generally perceived as a bad edit. French filmmaker Georges Méliès accidentally created the jump cut in 1896. He was filming a bus driving through a tunnel and his camera jammed. When the film began to roll again, the bus had already gone and another vehicle was in its place. Méliès later used the jump cut to create VFX. Jump cuts are often used for



effect, be it tension, urgency, the passing of time, or as a means of dramatic punctuation. They need to serve the story, and if sound is not considered with pictures, sound can amplify what can be perceived as a bad edit. Sound can smooth a problem cut to some extent, but it can't "fix" a poorly conceived edit.

### **Flash Cuts**

Flash cuts, or fast cutting, and sometimes called "hip-hop" montages, involve consecutive shots of a brief duration, sometimes interspersed with black frames for effect, are used to convey a lot of information quickly. In *Requiem for a Dream* (Aronofsky, 2000), the technique is used to show the main character's entry into drug taking and the impact of addiction through the use of extreme close-ups and equally "magnified" sound effects. The approach to editing and sound design effectively highlights the short-lived euphoria of drug taking, the subsequent despair and destruction that addiction causes. The same technique has since been used in films like *Shaun of the Dead* and *Hot Fuzz* (Wright, 2004, 2007, respectively) for comedic effect.

### **Smash Cuts**

A smash cut is when one shot abruptly cuts to another for aesthetic, narrative, or emotional purpose, usually at a crucial moment in a scene. Smash cuts are unexpected and therefore "jarring"; the intention is to startle the audience. Smash cuts are often used when a character wakes up from a nightmare to simulate the jarring nature of that experience. Typically, smash cuts rely on a big shift in both aural and visual information, such as a tranquil wide shot of a quiet, peaceful town, with a close-up of an axe splintering wood. Smash cuts are common in horror films, which rely on the shock factor. A sudden appearance of a boy in *Children of the Corn* (Kiersch, 1984) startles both the audience and the couple who hit him with their car. In horror, jump, flash, and smash cuts are usually coupled with sound effects, often visceral and "shocking" in nature. The many layers of a film's sound design are manipulated at specific points to scare. In Stanley Kubrick's *The Shining* (1980), treated dialogue,



sound design, and music build tension, which helps the smash/ flash cuts to deliver shock. We see Danny riding his tricycle down empty hotel corridors and we hear squeaky wheels; music and sound design preempt his vision of twin girls followed by a flash of seeing them murdered.



*Fig 6:6 The Shining (1980, dir. Stanley Kubrick), Warner Bros., Hawk Films, Peregrine*

### **VFX, Lighting, and Grading**

While the design and mix of a soundtrack should be discussed in preproduction and production, it's not usually until postproduction that all the separate soundtrack elements are heard together with complete and final pictures. VFX need to be locked before sound effects can be finalized, and any VFX revisions will affect sound. Most VFX work is planned in preproduction and completed during postproduction, but if the sound department is aware of the VFX being undertaken, then sound effects for the corresponding VFX can be prepared. Certain VFX can also be aided by sound effects, and sometimes sound effects are created first, before VFX, and then later revised alongside VFX. The way a shot or scene is lit also influences sound in different ways. High-key lighting makes a scene feel bright or soft, whereas low-key

lighting is used to isolate a subject, convey drama, or set a dark and mysterious atmosphere. Color grading also alters the tone, mood, and feel of a scene or film. As these processes happen at the end of the postproduction stage, sound may not see the overall effect until quite late in the production cycle. This makes viewing concept art early on helpful for understanding how the final film will look and how that might influence sound design and the mix.

## **AUDIO POST**

As previously discussed, the majority of audio work undertaken in both animation and live action film is during postproduction is sound design, editing and mixing. Audio Post is a broad term to describe the final stages of soundtrack production.

### **Track Laying and Session Management**

In soundtrack production, a project or job is typically called a “session” (a dialogue, Foley, SFX, edit, mix, or mastering session) and arranged in a way that makes it easy to manage the soundtrack, general workflow, and the transferring of sessions when working across studios. Feature film soundtracks are typically split across dialogue, effects, and music departments and therefore sessions are separated until brought together for the final mix. Small projects like a short film can be undertaken within one session and resaved and renamed as per the stage in the process (from edit to mix). Different studios have their individual methods or session templates, but they typically lead with dialogue tracks, followed by walla, atmos, room tone, SFX, Foley, sound design FX, and then music. This is because dialogue leads the mix, serving as a reference point, and other elements are “mixed against” the dialogue. Specific tracks are named according to the type of effects, for example, “foley1\_ footsteps.” The number of tracks in a session depends on the number of characters and how effects-driven the project is. A feature film, especially an action film, will involve hundreds of tracks, whereas shorts tend to have smaller track counts. In most DAWs (Digital Audio Workstations) such as Pro Tools, tracks can be moved around, so sessions can

be easily rearranged, dependent on the type of project and the production stage. Dialogue and ADR are laid up against either a guide dialogue track or conformed to an EDL. A track is set up and named for each character, and each line is placed in a “checkerboard” arrangement. Dialogue tracks are named as per the character for easy identification. Individual character lines are placed onto separate tracks so their dialogue can be treated independently. Perfect sync can be difficult to achieve, so dialogue or ADR editors use dedicated software which compares one line against the other and alters the duration of the rerecorded line to match the original sync line. This can also be done manually in most DAWs, but it is time-intensive and can involve stretching or reducing individual words separately. Atmos and room tones are laid up against and balanced with dialogue. This fills the spaces between dialogue lines or across dialogue in animation and ADR to ensure what is seen and heard feels natural and consistent. Once dialogue is balanced, it becomes clear as to where other elements of the soundtrack should “sit” relative to the scene. A busy city street will be louder than an empty warehouse situated on the outskirts of a city. Atmos (or ambience) and room tone also play a grammatical role in a soundtrack; when atmos is constant before and after a picture cut, it indicates the scene has not changed, and we are in the same location even though the shot perspective has altered. Changes in atmos typically signify changes in location and time.

Foley sound effects enhance detail and create the illusion of “reality,” or hyperreality when exaggerated. Like sound effects, atmos, and room tone, Foley can also be sweetened and in such a way that tells us something—a squeak added to a footstep, or a heavier sound like a “thump” to suggest weight. Despite the perception that “quiet sounds” don’t have the dramatic power of big or loud sounds, subtlety and overall dynamics add realism and emotion. However, if a scene is dialogue or musically driven, the subtlety and nuance of Foley is often lost, and especially if certain frequencies are being masked. If Foley is made louder to compensate, then the realism Foley brings to a soundtrack is lost. What takes priority always has to be ascertained,

and once dialogue has been balanced, it's best to pull down levels as opposed to increasing levels. There is only so much headroom to push into.

SFX and sound design effects play a large part in building tension and anticipation. Most sound designers and editors will create effects for everything on the screen, off screen, and in the case of sound design effects, everything “in-between.” “Sweetening” is an expression used to describe the adding, mixing, and finessing of additional sound(s) to an effect to “sweeten” it. A gunshot could be sweetened with a cannon blast, a low-end rumble, or a boom. A flame burst could be sweetened with an animal roar. Sweetening makes an event feel bigger or more dramatic and adds an emotive or psychological component. Integrating sound design elements adds another dimension to an organic physical place or space. In some films, especially the more abstract, or “otherworldly,” environments, the space or place is not real but built from sound design effects and textures. Music is often one of the last elements added to a soundtrack and is also laid up on individual tracks so that different music tracks can be cross-faded if needed. One of the key questions to consider or reconsider when laying up music is, where should music start and finish? This could be at the start and end of a new act, scene, or sequence. The other main issue is where music is sitting in terms of the overall mix. Is it competing with dialogue and effects?

### **Groups, VCAs, and Auxiliaries**

As soundtracks involve potentially hundreds of tracks or channels, most DAWs allow for controlling multiple channels as if they were one. Groups allow you to combine (group) and control a number of related tracks or “sub-groups” together. In soundtrack production, this is generally dialogue, effects, and music, but on larger-scale projects effects are often broken down further. Groups allow you to mix or “sum” inputs in varying amounts to a single output bus. Auxiliary sends/returns are typically used to create individual mixes and/or route a number of signals to an EQ or compressor or effects plug-in such as reverb. For example, sending all ADR tracks to a room reverb.

Voltage controlled amplifiers (VCAs) are similar to groups, because you assign a number of channels to a single VCA, but a VCA is only a level (or volume) control. Adjusting a VCA adjusts the faders for all channels assigned to it. For example, if all the Foley tracks were assigned to a VCA and the VCA was turned down 3 dB, each individual Foley channel fader is automatically turned down by 3 dB. The relative balance between channels stays the same, yet the overall level is reduced. Since no audio passes through a VCA, you can't insert any signal processing (compression, EQ) like you can with an auxiliary send.

### **Stereo or Surround**

Most commercial project deliverables include both stereo and surround mixes. There are a number of different strategies for working with surround sound, which involves deciding what elements will go where and why. Surround sound must serve the story and should be discussed in preproduction. Audiences generally don't like surround sound if it distracts or detracts, and many directors aren't fond of the overuse of surround for the same reason. Some directors opt for creating a largely stereo mix and only using surrounds for atmos and certain sound effects, or alternatively creating effects specifically for the rear and LFE (Low Frequency Effects) channels. Working in surround will also have an impact on budgets, schedules, and workflows between sound and picture editors. When working in surround both sound and picture editors need to be able to monitor in surround. On low-budget projects, filmmakers sometimes receive postproduction grants for a theatrical surround sound mix if their film has been selected for a "name" festival or has distribution interest. Most DAWs and picture editing systems support a variety of surround sound formats, 5.1 being the most common. This breaks down into the standard channels of left, centre, right, left surround, right surround, and LFE (low frequency effects). Most DAWs can also convert a stereo session to a surround session via altering the I/Os (input/output assignments). There are a number of plug-ins for "up mixing," which is the term used to describe the process of taking a stereo mix and making a 5.1 or 7.1 surround mix from it. As surround sound and home theatre systems evolve mixes can include extra

channels for overhead speakers. A 7.1.4 system is the traditional 7.1 layout with the addition of four overhead speakers.

### **Spatial Audio**

With the increase of 360 video and cinematic VR, spatial audio has also become a greater concern for content creators. In games, immersion is typically separated into three categories: narrative, tactical, and strategic. VR adds spatial immersion. Spatial audio immerses the user in a virtual space and “anchors” individual elements in that space to create a believable experience through headphones. The key difference between surround sound and 360 audio is playback; surround sound is played back through speakers, whereas 360 audio is played back through headphones. Ambisonics is the term used to describe full-sphere surround sound. Spatial audio is associated with the sense of “presence,” which is defined as a psychological state or subjective perception that “overlooks” artificiality and the role of technology in creating the experience. Dedicated software and plug-ins are used for creating soundtracks for 360 video and VR films.

## **RE-RECORDING MIXING**

From the 1930s on, re-recording technology was constantly advancing, and the soundtrack evolved from a mono track to several tracks. Re-recording, or “dubbing,” as it was called in the early sound era, was understood in much the same way as postproduction image was. Early practitioners compared both sound design and re-recording to the practice of shooting against a blue cloth (blue/green screen) and adding in backgrounds. Dialogue was recorded in the foreground, and then any background sound could be added. Other parallels between sound-image practices included matching photographic treatments and techniques with the similar approaches to sound. The process of re-recording was likened to playing music, except the picture on the screen served as the sheet of music.

### **The Re-recording Mixer**

Postproduction culture varies from project to project, city to city and country to country. On a large-scale feature film, re-recording mixing is undertaken by a team of mixers, usually three, separated into dialogue, effects, and music, whereas on lower-budget films and in many countries, the re-recording mixer is only one person. Sometimes individual editors/designers come together and mix their component as a team; for example, the dialogue editor would mix his or her dialogue tracks. The role of re-recording mixer is usually separate from that of sound designer, but sound designers typically attend the mixing session, and on smaller and independent films, the sound designer is often and increasingly the re-recording mixer. The main difference between the two roles is that sound designers are more concerned with content and re-recording mixers with context. It's the sound editor's, designer's, and composer's job to supply the re-recording mixer(s) with the *content*, and the re-recording mixer is responsible for shaping that content within the *context* of the film. Undertaking both roles requires creating and managing content in consideration of context. Key to a successful mix is objectivity in terms of the overall soundtrack, which is dialogue, effects, and music.

There are four phases to the entire mixing process: temporary mixes, premixes, the final mix, and M&Es (music and effect mixes). Once an edit is locked, sound design and music can start finalizing work in preparation for the mixing stage. Some directors are heavily involved in the process of film mixing, particularly the final mix, while others leave it up to the sound team. Sometimes directors are already on another project or are still working on finalizing pictures. Most re-recording mixers prefer the director to remain "fresh" and objective, which can be difficult to arrange in terms of scheduling, but it's always a good idea to have a break between processes to retain objectivity.

### **Temporary Mixes**

Temporary (temp) mixes for test screenings are useful for assessing if further experimentation is required and/or the degree of refinements to be made. Sometimes new and better ideas arise. A test screening is a preview screening conducted before its general release in order to gauge audience reaction. Preview audiences are selected from a cross-section of the population and are asked to provide feedback in some form. After audience previews, films are often recut, which means sound editorial changes and new mixes are needed. It's difficult to "lock down" a soundtrack before a final cut, so temporary mixes should be treated objectively. Test screenings are commonly conducted around the premix stage, which can be problematic for schedules, particularly if the soundtrack is still in development. Most picture changes will also require sound changes, which is where costs and schedules can blow out, especially if a number of test screenings are conducted with corresponding revisions. The types of revisions that commonly occur are usually story oriented, which can result in the shortening or extending of shots and scenes and/ or shot and scene changes. A close-up (CU) could become a wide shot (WS), or the scene order could change. Sound revisions can often take longer than picture edit changes, depending on the scale of revisions, which needs to be factored into revised schedules. Swapping a CU for a WS could result in the original sound design needing to be redesigned. Issues such as missing visual effects, and on animated films, inconsistencies such as a prop design, can also arise.

### **Premixing**

The next step in the film mixing process begins with the preparation of premixes, which involves the sub-mixing of many—up to hundreds—of tracks into a more manageable state. Dialogue, music, and effect premixes are mixed into what's called a stem. A stem is a completed premix and is usually in multitrack format, three to five 5.1 stems in the case of 5.1 surround sound. They are typically mastered through Dolby meters and bussed out as 5.1 stems of dialogue, music, and effects. Premixes



can also be divided further if the mix contains a large number of sound effects, for example separate spot, Foley, or atmos premixes. Twenty tracks of atmos could be mixed down to one or two six-track stems. Retaining some separation allows for the manipulation of individual elements during the final mix if required. During the premix, groups of tracks are combined and equalized in relation to each other. During premixing, the different elements are further assessed to “see” how sounds and different layers are working together before moving into the final mix stage. Sound editors/designers are often working in isolation, so it helps to have dialogue and music to work with during both design and premixing stages. The same applies to music composers; it helps to hear the dialogue and even temporary sound design. Each element of the soundtrack has volume, pitch, rhythm, and pacing, which need to vary to create interest and drama over time. Sound editors/designers generally do as much in advance as possible and often premix as they design. Certain sound and design effects need to be premixed as part of the sound design. It can be difficult to know if something “feels right” without some preliminary mixing. Sound editors/designers will adjust levels and add fades and volume automation. Premixing helps set up the mix so that the mixer(s) can focus on finessing the overall balance, instead of making a lot of small adjustments. As the soundtrack builds, a rough mix of the individual elements is created from scene to scene; however, it’s not until sound design is complete that an effective mix is possible.

### **The Final Mix**

During the final mix stage, the soundtrack is further refined in consultation with the director. Some directors are not always actively involved in the mixing stage and may only attend review sessions. The final mix for a feature film can take between two and twelve weeks, and sometimes much longer depending on the film’s scale, budget, and how much premixing has been undertaken. During the mix, all the soundtrack elements or stems are adjusted in volume and equalized relative to each other and the image. Reverbs are added and individual elements and effects are panned. The key decisions made during the final mix are which sounds should be emphasized, thinned,

or dropped depending on the impact of the overall sound within the context of the pictures.

### **M&E Mixes**

M&E stands for “music and effects,” which is the entire soundtrack minus the dialogue, and is used as the basis for foreign language dubbing. The dialogue is recorded and dubbed in the relevant language. It’s easier and less expensive to prepare an M&E after the final mix as opposed to at a later stage. Creating an M&E is an additional cost, so some independent films opt for using subtitles instead, particularly for short and non-commercial films. For commercial films, M&Es are typically part of the deliverables required for distribution and include dialogue sheets, which are transcriptions of all spoken language (dialogue and voice-over or narration) and where in the film dialogue occurs. Dialogue sheets are then transcribed into different languages for either subtitles or foreign language dubbing.

## **MIXING TOOLS AND TECHNIQUES**

Since the late 1970s, films have become increasingly more complex, which means the process of mixing film soundtracks is more complicated. The mixing process “refocuses” attention to what’s important at a given time, and even a small adjustment in level or frequency can have a dramatic effect. Sound is perceived both emotionally and intellectually. Constant choices are made as to what elements need to be heard and to what extent. Film is an illusion, so it works by suspending disbelief, and different genres demand different approaches and sensibilities. A good mix feels seamless and doesn’t distract or make the audience conscious of the soundtrack and the film itself. The main aim or purpose of the soundtrack is to support the emotion and story, and generally the better the mix, the less the audience is aware of it.

## **Dialogue Mixing**

After the coming of sound in the late 1920s, the use of dialogue became more prevalent in both animated and live-action films. Dialogue is often considered “king” and the most important element of the soundtrack mix. Dialogue is mixed first and all other soundtrack elements are then mixed against the dialogue. Films are mixed with the dialogue set to a specific level, and all other audio elements are “subordinate” to the dialogue. When at home watching TV or a film, most people will adjust the volume to comfortably hear the dialogue. The easiest way to balance dialogue is by locating and leveling the loudest line so that all other lines can be adjusted in reference to the loudest line. Perspective is important. For example, if the audience sees a WS and the dialogue sounds too loud or “present” or “close,” it will feel as though something isn’t right. Audience members will be unlikely to isolate the problem, but they will notice and be critical of it. As a rough guide, dialogue levels will generally sit within an average range of around -24 dB to -18 dB relative to the visual perspective. A CU shot of a character talking loudly or yelling may peak at around -10 dB. Aside from elements like crowd walla, offscreen and muffled conversations through walls, or effected elements such as radio “chatter” and telephone conversations, important dialogue needs to be audible and understood. In live-action film, matching location sound and ADR is challenging because of the variations in microphone placement, reverb, and locations. The same problem can occur in animation if dialogue has been recorded with different microphones in different studios. A common solution is to paste and cross-fade atmos, room tone, and/or use software to match room tone, atmos, and ambiances. Depending on the quality of the recording, unwanted noise is removed, either edited out/around or through the use of EQs and dedicated noise reduction plug-ins. The dialogue mixer focuses on getting all the dialogue levels right, EQ, adding reverb, and other effects to ensure what we are seeing and hearing feels “real” and is consistent.

## Effects Mixing

The original thinking behind the concept of sound design was to establish a person who took on the responsibility of “auralizing” the sound for a film, like a director of photography or art director, but for sound. Sound effects mixing is often compared to cinematography and compositing. Cinematographers focus the lens on a specific area of a shot, which draws the audience’s attention. Other elements are still visible but are soft or out of focus. This applies equally to sound design and mixing; raising or lowering the volume or equalizing a sound effect, or stem influences the audience’s focus. Compositing is the combining of visual elements from separate sources into a single image, sound design is effectively combining a number of separate sounds into what feels like a single sound effect. A mix combines many elements into a soundtrack. Sounds are chosen and mixed to make each moment realistic and/or emotionally targeted. Different films have different mix aesthetics, particularly when it comes to effects. Some mixes involve grouping layers of sounds within a frequency spectrum. Another approach is to focus on one or two principal foreground sound effects at any given moment, which makes the audience think they are hearing more than they are. The more pared down a soundtrack becomes, the more freedom there is for events and moments to feel bigger than they are. Films perceived as “quiet” take the “less is more” approach to a greater extreme. *No Country for Old Men* (Coen Brothers, 2007) is well documented for being a “quiet” and tense thriller. There is minimal dialogue and music, but as Ethan Coen described it, it’s “maximal” in terms of sound effects and how they were handled. Sound can be emotionally effective even when reduced to near inaudibility, and the sudden absence of sound can have a dramatic impact.

## Music Mixing

One of the biggest conflicts that happens in the mix is competition between dialogue, sound effects, and music. When a mix is “muddy” or lacks “definition,” it’s usually because it contains too much energy in the lower mids and/or bottom end of the

frequency spectrum. A certain type of sound with a certain type of music can muddy a mix. Ideally, sound designers and composers are collaborating to avoid this, but because of budgets and schedules, it doesn't always happen. More often than not, either sound effects or music are removed, thinned, or reduced in level. Music doesn't have to be there all the time, but sound effects do to some extent. Music can come and go, start and end, whereas effects in the wider sense are always present, often synced and/or "attached" to the visuals and story world. Early discussions between the sound designer and composer can isolate pitch/ frequency "double-ups" to inform instrumentation and sound design to set up clarity in the mix. This is what Murray Spivak and Max Steiner were exploring on *King Kong*, and what Skip Leivsay and Carter Burwell do on Coen Brothers films.

### **Panning**

Dialogue comes from the center speaker irrespective of the placement and movement of characters. Panning dialogue is distracting and sounds unnatural to audience members who aren't sitting in the center of the cinema. Spot sound effects are positioned carefully and generally not too far left or right. A door might appear on the left edge of the screen visually, but if panned hard left, it may appear too far away from audience members sitting on the right. Atmos, music, and reverb can generally be panned anywhere in the stereo and surround spectrum because they're not visually "anchored"—not something that you see, so not something that will make an audience member turn away from the screen. Certain sound effects and elements like helicopters are panned relative to visual suggestion; they can fly over the audience, or from front left to rear right. Creating soundtracks for VR film is different to working in traditional film; sound is 360, often used to direct the audience/user, and there is no screen.

## **EQ**

One of the most common EQ (equalization) techniques in film sound mixing is “notching,” which is essentially pulling down the volume of a specific frequency or frequency band, particularly when faced with masking issues. For example, if dialogue and music are competing, “notching” frequencies common to dialogue, from the music will make the dialogue “pop” through. Dialogue can start to sound unnatural when certain frequencies are pushed or pulled too much, so a good rule of thumb is to look at equalizing effects and music, not dialogue, when dealing with masking issues. When in doubt, using frequency analysis plug-ins helps to ascertain frequency issues. Another common technique in effects mixing is “rolling off the bottom end”, which involves equalizing or using a HPF (high pass filter) to reduce lower frequencies. This can add “clarity” to mixes that are going to be played back through consumer headphones and speakers, which are not designed to reproduce much in the way of lower frequencies.

## **Compressors and Limiters**

Compressors are used extensively in audio post, especially for broadcast applications. Compression is the process of lessening the dynamic range between the loudest and quietest parts of a stem or entire soundtrack. Compressors boost the quieter signals and attenuate the louder signals. Theatrical mixes can have a huge dynamic range because they are played back in a quiet, controlled listening environment (a theater). Broadcast, video, and online mixes have lesser dynamic range because of the final listening environment. However, over compressing can destroy a mix, making it feel “squashed” and lacking in detail and dynamics. Limiters are commonly used in broadcast mixes to ensure that they do not peak over a set threshold in adherence to delivery specifications. A compressor smoothly reduces gain above a threshold, while a limiter prevents any additional gain above a threshold.

**Reverb**

In the early days of film, it was difficult to get realistic-sounding reverbs, reverb units were unnatural and metallic sounding. The way around the problem was to rerecord material in a similar acoustic environment to the film, or “worldizing” an expression coined by Walter Murch. This involved playing back the original material on one machine, usually a Nagra, recording or re-recording the audio in a space with another machine, and then blending the two recordings together. Today, there are a number of reverb plug-ins used to recreate reverb and therefore spatial realism. Mixers adjust perspective, determined mainly by the ratio of direct to indirect or reflected sound, which creates a sense of depth and space. Surround reverb plug-ins are typically used for overheads or surround objects to create a sense of depth and space. Interior spaces such as different rooms are relatively easy to re-create with reverb plug-ins, but exteriors are more difficult to get sounding natural. Sound in a forest or sound reflecting off a building is a more complex event. As previously mentioned, convolution reverb allows an impulse response or “snapshot” of the acoustic characteristics of real locations to be recorded and converted into set parameters. In postproduction these are used to create more realistic and accurate reverbs.

**Monitoring the Mix**

Professional mixing studios are acoustically treated and calibrated for accurate monitoring of mixes relative to the type of mix. Large mix facilities at 85 dB, and smaller facilities at 79 dB. Monitoring too loud in small mixing studios causes inaccuracies because the ear hears frequency response differently at different levels. We are less sensitive to lower frequencies, compared with higher frequencies. Monitoring a mix involves looking, listening, and metering. The mix should feel balanced, and sound and image should present as a unified whole. In mixing sound for film or television, there are specific standards that have been established and passed into law. Loudness meters provide precise loudness measurements and are compliant with all international specifications and broadcast deliverables. They

measure audio like the way we perceive sound, taking into account duration as well as frequency. In addition to loudness, content is also assessed on dialogue, or “dialnorm” (dialogue normalization) to ensure consumer dialogue levels are consistent from program to program and channel to channel. There are variations in how we judge loudness, but we’re fairly consistent when assessing dialogue, and most people react negatively to dialogue that is too loud. Audiences will always notice and complain about badly recorded, synced, and mixed dialogue. In mixing sound, there are also very specific standards that have been established and passed into law, for example the Commercial Advertisement Loudness Mitigation (CALM) Act of 2010, which came into effect in 2012. There are different audio metering scales, which have been developed by different industries in different countries, for different applications. Loudness meters provide more precise loudness measurements and are compliant with all international specifications. They measure audio similarly to the way humans perceive sound, taking into account duration as well as frequency, which is more consistent with the way we hear. They are used to evaluate everything from trailers and commercials to feature film soundtracks, for comparison purposes, to alert mixers to the potential for audience complaints about loudness, and to adhere to broadcast industry standards.

### **Mastering, Encoding, and Delivery**

Film soundtracks don’t get mastered in quite the same way as music is mastered. Music mastering engineers fine-tune levels and equalization of music so that it’s balanced and the levels are constant with other CDs or tracks on the market. The process involves optimizing average and peak volume levels; signal processing (compression and EQ); removing unwanted noise like clicks, pops, and hisses; arranging tracks in sequence; and inserting codes for replication. Most of this work, applicable to film, is conducted during editing, premixing, and the final mix of a film soundtrack. The way a soundtrack is mixed, mastered, and encoded depends on the project and the distribution model. As previously discussed, delivery requirements



need to be ascertained, planned, and budgeted for in preproduction. Most audio postproduction facilities take care of deliverables for broadcast, Web, mobile, over-the-top and streaming, games, DVD and DCPs (Digital Cinema Packages). Commercial feature films are mixed on a calibrated mix or dubbing stage with dedicated personnel to particular specifications, and then mastered and encoded relative to distribution and replication requirements. A consultant ensures the mix theater is aligned and calibrated correctly, evaluates the mix so it translates to cinema, helps in the creation of other deliverables (Blu-ray etc), and checks the first copy of the DCP or 35 mm print so it meets standards. The certification of theatrical mix theaters is dependent on room acoustics, audio and visual monitoring standards, equipment selection, installation standards, synchronization accuracy, mixing competence, and technical experience.

### **Common Mix Issues**

On large projects like feature films, the sound department is often working individually, which can result in the preparation of too much material. Despite advancements in audio technology, there is only so much information that can actually “fit” into a soundtrack. Dialogue, sound effects, and music regularly “compete” for space. “Auditory masking” (or frequency/spectral masking) is the term used to describe what happens when one sound is affected by the presence of another sound. When too many sounds with the same frequencies are layered together, the louder sounds mask the quieter sounds, diminishing them. Certain sounds (with a broad frequency spectrum) like running water, traffic, and air conditioning tend to mask higher-frequency and softer sounds. The brain is able to single out simple frequency ranges but has trouble when too many frequencies are heard at once. The knee-jerk reaction is to make the quieter sounds louder, which in turn masks and therefore diminishes other sounds. When music and effects contain the same frequency range as dialogue, depending on the level, they will mask the dialogue and the dialogue becomes inaudible. The same problem occurs if music and effects are both

punctuating the same screen action and in the same frequency range. EQs and filters are used extensively to create greater separation between dialogue, effects, and music. When composers and sound designers collaborate, they can create “space” by avoiding hitting a specific sync point at the same time, or by avoiding creating material in the same frequency range.

In summary, having an understanding of sound and picture postproduction concepts enables a much greater insight into how creative sound and image techniques can be explored earlier. The success of a project is dependent on a good story, and the ability to exploit sound and image to their full capacity. The traditional film production model is an outdated convention. Collaborative workflows are the way to achieve this. In animation, the edit and the soundtrack are effectively being developed through story reels, and increasingly live action is following suit. As VR film evolves, sound will need to be considered earlier and alongside image, particularly if the intention is to create creative immersive cinematic experiences.

I think this collision of gaming and live action and animation is changing the way films are made. Often, before I have a screenplay for a movie, I'll have story room, or locations photos and bits of character design, and pin it all up. The idea of narrative being informed by visuals and storyboards and text is exciting, and there are a lot of thumbprints on the sculpture by the time you're done with it. Everything's progressing, especially in terms of post. Looking ahead, I'd love to have more of an open format and the conventions of how we manage post done away with. As much as I enjoy sitting in a room alone with my editor for 10 weeks, I also can imagine a Star Trek Enterprise bridge version of the edit room, where you look over to Uhura and they're your sound design person. We seem to edit and then do sound, or finish things and then do visual effects, and I feel more and more that it should be far more fluid—I've got a new idea, let's try it and loop a line of dialogue, do a quick character sketch, change what we're not happy with, and maybe that will lead to a re-

shoot or a pick-up or a new visual effects shot, but we're going to try stuff. So the sound designer informs how you're going to cut things, and maybe the composer comes on earlier. Instead of traditional post where it all stacks up at the end of the schedule, I'd love to open it up in the editing process, with everyone in there together. (Verbinski in Blair, 2011)

### **Godplex – Feature Film (online)**

*Godplex* tells the story of how an insurance consultant-cum new-age guru navigates the brave world of spiritual communication, his identity dissolving into the characters that follow him as he attempts to re-awaken with his own enlightenment. Inspired by 'elephant consciousness', Clark Duke has created Virtology, an internet religion with which he plans to enlighten and change the world for the better. To his delight, he attracts thousands of followers, among them a gender-confused teen, an over-zealous journalist and a threatening character who seems to share a psychic connection. Clark's house burns down under suspicious circumstances – he hooks his boat to his van and heads out on an evangelical mission of absurd and tragic outcomes.

The film blends pseudo-documentary, black comedy, with surrealism and expressionism, reminiscent of 1960's counter-culture avant-garde cinema of the 1980's. Comedic on one hand, dark on the other, and as the film progresses Clark's world becomes increasingly absurd and dangerous. The visually hallucinatory style, with repeating motifs and symbolism needed a complimentary sonic aesthetic. The opening sequence combines sound design with two completely different music tracks, representing the two lead characters, and the worlds they inhabit. Many scenes are sound design driven; minimal dialogue with no music. They are indicative of the journey Clark takes, from a psychological internalized perspective.



*Fig 6:7 Godplex (2018, dir. Darcy Gladwin)*

The film is characteristic of a low budget independent film process; leaving consideration of sound to postproduction. First time feature film directors have a propensity to underestimate the degree of audio postproduction work required. It is usually during postproduction that sound issues become apparent. There is an expectation that sound designers and re-recording mixers can ‘fix’ these problems. Professional audio postproduction is expensive and independent budgets are low to non-existent, which makes it extremely difficult for filmmakers to fully realize their films. Rarely do independent filmmakers budget adequately for audio postproduction, which impounds when production sound has not been adequately addressed.

Production sound was not considered during the production of *Godplex*. The director felt that production sound slowed down shooting of the film. Despite having directed short films in the past, he was unaware of the implications of forgoing production sound. For example, instead of using a production sound mixer he used the camera microphone. This neglect meant the soundtrack had to be completely re-created; a massive undertaking. There are specific scenes that could have easily been recorded

properly, for example, a scene where the lead character is being interviewed in a radio studio; there are professional broadcast microphones in the shot. In another scene, he is being interviewed for a mock television show, where seeing a lapel microphone is standard. In another scene, the lead is performing spoken word, into a microphone, yet this was also not recorded properly. In addition, he continued re-editing the film, which resulted in a lot of time spent on re-syncing material. The film, which started in 2007, is still not completely locked, it has undergone additional edits since it was pre-mixed.

*Godplex* would be a better film if the director had taken sound on-board earlier in his filmmaking career. Worth noting is his insistence on sound design being credited in the film's opening, to acknowledge the scale of work undertaken, but this is way too late in the process. The online clips illustrate a "before" and "after", illustrating the many challenges and work undertaken, however it is still incomplete, undergoing further edits, and has not been accepted into any film festivals. It serves as an example of what not to do, common in independent filmmaking.

## CONCLUSIONS

During the process of research, writing, working on a number of films, and teaching, it has become apparent that sound faces an uphill battle. A key barrier for change is in the complexity of sound and the technical knowledge required to fully understand sound and production processes. Visual work is more easily and readily "accessible". The technical "stigma" sound suffers is an unavoidable reality, sound is an art and a science. However, the perception of sound as merely a technical discipline obscures the opportunities to use sound creatively. Technology provides the means, but like other film crafts, sound design is an artistic discipline. Film is too frequently described as a "visual" medium, which negates sound, and consequentially hinders the potentials for both sound and image. The absence of attention on sound in preproduction has a flow on effect into production, postproduction and distribution.

To compete, independently produced films need to be of a certain ‘quality’. Distributors and festival selectors are unlikely to select films with ‘bad’ sound. If sound practitioners spend increasingly limited time on problem solving, then creativity is marginalized, and a film might look great, but audiences do not engage with ‘poor’ soundtracks. A poor-quality soundtrack will undermine the visual.

“Mise-en-scène” is an expression used to describe the design aspects of a film production and is often defined as the “visual theme” or “telling of a story,” referring to everything that appears before the “camera” or in the frame. Sound is also part of a film’s mise-en-scène because it pertains to anything in a film or story world. It’s just not *seen*. One of the main differences between sound and image is that audiences rarely notice the soundtrack, unless there is a problem. Likewise, filmmakers rarely consider sound, until they have a problem, which is generally during the postproduction phase. While the convention of picture first and sound second is still the prevailing mode of production, sound can be considered, conceptualized and conceived *with* instead of *after* visuals in the overall production process. More attention to sound in preproduction can help prevent postproduction issues, which elevates a film’s potential for distribution, and therefore a filmmaker’s career opportunities.

Sound has a tremendous history and palette to draw from. When Luigi Russolo predicted the future of music was in the way sounds could be combined to create new sounds, he was defining one of the key aspects that underpins contemporary sound design. Russolo was also identifying the potential of emotional responses to nonmusical sound. The sound designer’s primary job, regardless of the medium, is to collaborate with the director, to identify what kind of soundtrack will suit the overall “personality” of the film. Defining the aural direction of a project needs to start with initial discussions concerning genre, story, character, and environments. Documents and materials generated throughout script development can help inform approaches to soundtrack design by elaborating on a film’s narrative, aesthetic, and emotive

dimensions, which is not always apparent in a script. Certain sound elements are evident, for example, “a dog barks in the distance”, but conceptual, psychological, and emotional aspects are not. Engaging with and utilizing development materials gives both the director and sound designer the opportunity to get between, beyond, and beneath what’s written on the page. A script will go through a number of drafts before a final draft, which means there is plenty of scope for considering sound throughout script development. While it isn’t common to be working on both sound and picture simultaneously, *thinking* about sound and picture simultaneously generates ideas that can then be incorporated into a script. Sound is editorial; it affects story and shapes the emotional content of a scene. The success of a project is dependent on a good story, and the ability to exploit sound and image to their full capacity.

There is no definitive path to designing a soundtrack, but there are parallels with visual disciplines; sound recording is like cinematography, sound editing is like picture editing, sound generation is like animation and VFX, creating sound design effects/textures and other aural elements is like music composition, sound mixing is like compositing and color grading. Key to developing a more collaborative production methodology is the ability to engage and draw from other, both similar and disparate disciplines, processes and practitioners, which requires a less linear approach to teaching and education. In animation, the edit and the soundtrack can be developed through story reels, which is pre-vis, incorporating sound is pre-auralvis, and increasingly live action is, or should be following suit. As areas like VR film evolve, sound will need to be considered earlier and alongside image, particularly if the intention is to create immersive cinematic experiences.

Returning to the key question underpinning research, can a text-based book actually address this? My final conclusion is no, the subject area is audiovisual and requires a much greater audiovisual approach to “literature”, further research, more innovative approaches to research, and more opportunities for practice-based sound researchers.

While this final statement appears negative, *Sound Design for Moving Image* has been published, and serves as a basis to extend on existing research and content creation. The aim of this research was the writing of a book, for students, to draw sound from the shadows, offer up new ways of thinking about sound, and shed some light on the practice of sound design. Having a greater understanding of sound, its history and the practices that underpin sound design is also crucial to addressing the discrepancies between sound and image, particularly in education. I envision building on the current publication, and integrating it more fully into my own teaching practice and ongoing curriculum design. It is difficult to imagine true parity between sound and image in the short to medium term, particularly in education, however emerging filmmakers, animators and sound designers have greater access to technology and information than ever before, which opens the door to a more inclusive approach to the creation process.



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