AUDIO IN MULTIMEDIA –
ITS FAST CHANGING METHODS AND GROWING INDUSTRY

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Sebastian Schneider

Lahti University of Applied Sciences
Faculty of Music

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ABSTRACT

This thesis aims to acquaint the reader to modern aspects of audio creation techniques, its implementation aspects and business related issues as a standalone industry. I express that through technology the music industry as a whole has allowed development and progress into manifold areas. Circumstantially for musicians with a rather traditional education background I propose that a familiarization of this field can be very beneficial for ones own development. In a modern digital age many musicians may experience difficulties to propagate their own achievements to the outside world with contemporary means of computer technology. Therefore becoming adept in related topics may even become crucial. This thesis can help as a lead in and eye opener of current trends.

My decision to write about the presented subject, culminating in this thesis, has been initialized through my own previously obtained experiences. I have started several years back by myself to engage my knowledge in music with audio multimedia development processes. Thereby this area and gathered experience through self study, research and increasing professional experience. This knowledge made me certain to progress further into this sector as outlined in this thesis.

Through an expanding fast paced advance in multimedia the role of audio became increasingly important and still does so nowadays. Newly created job opportunities emerge as a result requiring an ever augmenting specialized workforce. However, often unmatched in the education sector many people still origin from a partly "self-thought" basis. I share this perspective but learned to value it as a challenging but rewarding experience.

Keywords: audio, multimedia, music and sound, digital and analogue, film and game, interactive media

TABLE OF CONTENTS

1 INTRODUCTION (MULTIMEDIA AND AUDIO)

When introducing multimedia and audio it is important to outline various aspects part by part instead of focusing on only one small aspect. I guide the reader through basic definitions of necessary technicalities without getting bogged down in too much detail as this would impede the purpose of this writing. I outline work procedures and give some insight of the industry in its current appearance. I decided to accustom the reader to my own development and hence show an example of how one may come to work in this sector. And additionally to disclose own background information to round up the overall thesis output.

I explain the terms “multimedia” and “audio” as necessary means in order to have an oriented terminology throughout the thesis. Within the second part the definition of what the terms analogue and digital stand for are given. I compare both ways in perspective to audio as a way of an historical lead in. I show the necessary interlinked change of approach in audio creation that comes through the digital revolution and with that newly created tools. Thereafter follows a review describing modern creation procedures in music and sound design. I refer hereby to modern trends that often require one to be a “multiple expert” within the audio sector. Through various circumstances in the professional industry composers can become sound designers in part and vice versa and with that an increasing requirement of newly trained specialists exists.

The next section focuses on the business and consumer behavioural aspect clarifying the emerging and growth in the industry in part and as a whole. Following will be some of my own experiences, including a follow up how I came to do what I do, and a presentation of some of my work in respect of the previous mentioned topics. A CD is included that carries all of the documented files. A final conclusion will then summarize the thesis.

I felt this comprehensive structure was necessary to form a solid overview and achieve *the goal of clarification to a reader that so far had a rather pure music background* and has maybe even never heard of for instance sample music techniques and alike. I feel that musicians need to know how *they can be heard* and what modern means they have at their disposal to create and enhance their own work. While some classes are available many more traditional instrumental and music education courses unfortunately fail to introduce or even mention such possibilities to the students. It is therefore in the personal responsibility of the graduate to familiarize themselves with this sector as much as they deem necessary for their future career path as a professional musician. This thesis debates and is constrained to audio development processes in multimedia and does not mention options in regards to a musicians self-publication. Such prospect is up to the further research of the reader himself.

Multimedia in its current form has only emerged over the last three decades and rapidly became one of the most influential appearances in peoples every day life. All recent derived appliances and devices can prove this statement easily: from early mobile phones to modern integrated camera devices over Internet with instant availability messaging services to interactive consumer controlled film and game content and new generation education possibilities, the influence of multimedia can be experienced nearly everywhere.

Originally beginning as a pure “for-entertainment” sector it grew substantially to gain foothold in other important areas. As introduced such as daily work and education. Its continued evolvement rapidly incorporates itself interactively in most domains throughout our personal and professional life nowadays. And yet no end of this progress is in sight as new forms of multimedia based advancements are still being developed frequently. The media scholar Pierre Lévy takes it even so far as to name multimedia as a “catalyst for social evolution and the architecture of the future (…)” and a “language of the new era”. Such theories are based on concept of collective intelligence amplified through the Internet and similar forms of media. (Lévy, 1994, 46)

But what exactly is multimedia? To present an appropriate definition it is necessary to look at the main characteristics in order to draw a framework. The use of the word “multimedia” has first occurred in the sixties when public performances were combined with other visual art forms. Such events would be rock concerts that integrate cinematic and/or various light and laser shows.

About a decade later, during the seventies, “multimedia” more frequently became a synonym for multi-projected slide shows that were matched to an audio track. Two or often more devices were able to simultaneously create large scale projections. It often would have been used on half circle canvases to create an artificial surround imagery impression. Modern remains of those techniques are media created panoramas nowadays primarily in museums and art exhibitions and as modern multi projectors. (Barabash & Janice, 1998)

Only about one decade ago, during the nineties, the meaning of “multimedia” has emerged as what we commonly understand it today: The electronic delivery of multiple combined media such as audio, text, video and images in a single merged entity. The word “media” grammatically describes the plural derived from medium and multi and therefore already carries the meaning of plural itself. That is why it is argued (under modern definition) not to name multiple items of the “same media instance” multimedia in order to avoid confusion. For example multiple music tapes carrying none other than only audio content on them, should not directly be categorized as multimedia.

As a result the term remains ambiguous in day to day language as it is often misunderstood what forms of multimedia go under the characterisation span.

Furthermore the term is commonly abbreviated only using the word media but instead meaning multimedia. Naturally this adds even more confusion. Speaking of multimedia inside this thesis I refer to the definition of multiple combined media as introduced previously.

Multimedia can be categorized into linear and non-linear content. As the name suggests, linear forms of multimedia progress without any viewer control (e.g. cinematic presentations). Opposing to this non-linear multimedia enables the consumer to interact with the media content and even influence its outcome (e.g. video games). The object can either be active or static. Active describes a "by itself" progressing active entity of media while passive means a still "not in motion" one. Those could be TV versus book for example.

For the purpose of completion and reference later on in the thesis, I will state a definition of what Audio is in reference to multimedia: Audio is the audible part of a transmitted signal that is a recording/reproduction of acoustic signals; therefore sound: [sound is the] *vibration transmitted through a solid, liquid or gas, composed of frequencies within the range of hearing and of a level sufficiently strong enough to be heard (…)* (www.bartleby.com, 2009)

However it is important to realize that audio has several appropriate definitions that are each applicable within their own context. The meaning inside multimedia differs slightly from the previously stated: Here audio is distinguished into two categories. Those are sound and music, whereby the meaning of "sound" as such does not coincide with its previously stated definition neither. Logically sound cannot try to define audio while simultaneously being a member of it.

What it really implements is the meaning of sound in multimedia describing essential sound-effects. Those are used to underline the motion picture. Examples include footsteps or car sounds in a movie as outlined later on. People often refer to this part of audio as the "Sound FX" meaning "effects" as in sound effects or simply just "sound". This vernacular has derived out of common application practise and daily language and does not coincide with dictionary terminology. However it is commonly used throughout this industry and will be referred to equally within this thesis.

The meaning of the term music in multimedia is often more freely used than maybe common in other areas. It can include or consist of sounds as well. Nevertheless in a multimedia production the music track is usually everything else that is audible, other than the underlying implemented sound-effects synchronised to the key events.

Both audio-categories: sound and music with all its aspects again have subcategories that I will go into a bit more depth later on.

2 JUMP THROUGH DIGITAL REVOLUTION

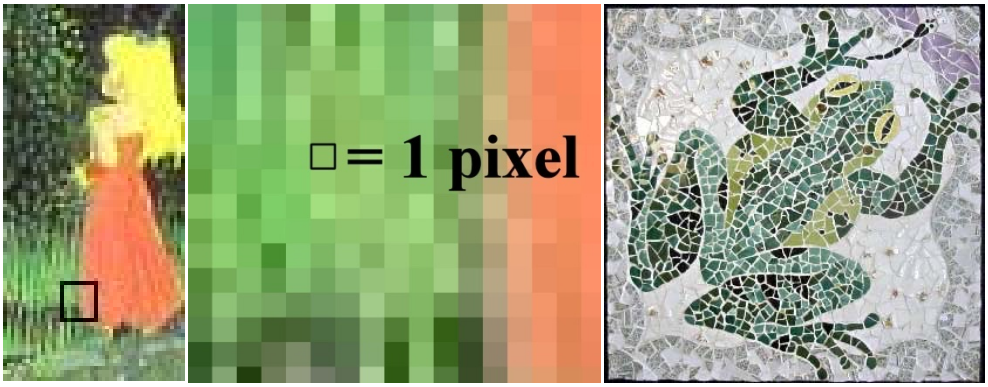
I think it's fair to say that personal computers have become the most empowering tool we've ever created. They're tools of communication, they're tools of creativity, and they can be shaped by their user. (Gates, 2004)

2.1 Analogue to digital

Substantial advancements in digital computing introduced major changes in media development and delivery processes since the 1970s. With the appearance of the public Internet during the early 1990s this development was accelerated even further. Literally any digital file could be send within seconds to the other end of the world. Increasing speed paired with decreasing data sizes and constant availability enabled us to completely change our working routines and general consumer behaviour. In reality the technological revolution allowed us to take the step from analogue to digital. I will clarify what those terms mean and what the implication is in relation to audio creation.

The used term “analogue” originates from the meaning “representing” as in an analogy. For example a clock on the wall represents the time with its present position whereas the hands will move continuously while time is in progression allowing “any time” to be possible (meaning: in between the seconds). “Digital” derives from digit considering any statement carries always a single precise meaning. The time at a digital clock always specifies a distinct numerical value and never anything in between. The meaning of digital goes hand in hand with the term binary. Binary describes a combination of zeros and ones (binary equals twofold, either 1 or 0, on or off etc.) based on computer apprehensive langue (code). Therefore it is a clearly defined, definite value used by all modern computers to store and process data. (www.bartleby.com, 2009)

To give another example: an analogue (real) painting has a smooth colour progression as one colour flows into the other one continuously. A digitalized (binary) painting has a clear distinction between its parts. We speak hereby of the resolution. It describes the amount of “parts” (called pixel) used to paint the whole picture. One could compare pixels to the stones in any mosaic or the puzzle parts in a puzzle. Mosaics could be viewed as the first pre-digital pictures with similar attributes. Each part has a clear defined border. The more stones are used the better and sharper the mosaic picture will look like. The same goes for a binary picture on a computer, the higher the amount of pixels the better the overall quality will be.



Picture 1 (left): Example picture (Game spy 2009) – Picture 2: Strongly zoomed in excerpt in order to visualize pixels – Picture 3: Stone frog mosaic (Line Art Gallery, 2009)

The same principles apply to audio. Any analogue sound is defined as a continuously flowing entity (for example the sound of a playing violin with all its nuances). Live forms of sound (live performance) always count as analogue as we *directly* hear them.

However analogue recording techniques are based on explicit transmission methods. Examples are for instance gramophones and tape recorders. A traditional gramophone recorder converts sound waves into physical representations on a stereophonic disc (record). Those can later be reproduced by a gramophone player with the needle “riding” on the record and thereby transforming the physical surface back to sound. A very famous application of early uses of this technique are Bela Bartoks folk music recordings from around 1900. (Public domain 1978)

Picture 4: Bela Bartok using a gramophone to record folk songs sung by Czech peasants in 1908 (Public domain, 1978)

However if a recording is digitalized the essential sound is transformed (into something none physical) and then stored digitally. The representation equals multiple events called samples. Every time an audio signal is converted from analogue to digital (for instance via recording to a digital storage like a computer) the analogue sound will instead be stored as those samples and in return the computer can directly visualize a graphical equivalent of the audio wave on screen. Therefore naturally, the higher the amount of samples used, the better the reproduction and quality of the original sound will be. Just like in the mosaic or a digital picture.

In more detail: all of the captured signals (analogue violin playing recorded to the computer) are being stored ultimately as binary code.

It is important to recognize that once a digital file is played and we can hear it from a speaker we call it analogue. This means that *everything that is audible is analogue* as outlined previously. One cannot hear digital because digital only exists as a stored medium on “for digital defined” storage (like a computers hard drive). At the moment that a file is played it is being converted ultimately by the speaker into analogue audible signals. (Kester, 2005, Chap 2)

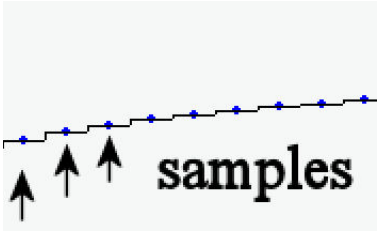
But what are the essential benefits to move from analogue to digital and are there any downsides? This topic is one of the largest discussions since the implementation of digital audio in the professional audio sector.

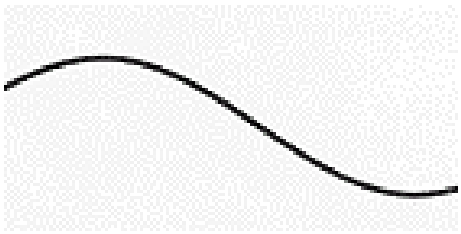
For one, it cannot be neglected that digital content is much smaller (or literally none weight as a file on the computer weights nothing additionally than the computer itself), easier accessible and transportable at a click over the internet or to any player device (e.g. mp3s). Opposite to this, analogue stored audio always needs a carrier (e.g. a tape). The reproduction can only be done by a specific hardware player and is not transferable (a tape can only be played by a tape player while a file can be played by any medium that can carry digital content and has a connected form of output). Transportation of analogue content is evidently difficult as it effectively needs to be send physically by post or similar means on the specific carrier.

While digital content is stored in binary format it enables the computer to reproduce the signal *exactly* the same as originally stored. This derives from the fact that all the information is definite (ultimately either zero or one). This means that there is no loss of information ever. The file can be copied unlimited times and will never lack any quality or be different from the original file. Analogue content on the other hand does loose on quality when continuously transferred and can easily suffer from damage (e.g. magnetisation of a tape). Even though nowadays more professional modern analogue recorders used in studios have somewhat overcome this quality loss by transfer problem.

So what is the hold up? Why not change everything to digital and get rid of analogue completely? The problem increasingly recognized by the professional audio community describes that digital recordings do not fully deliver the warmth and deep rich sound of original analogue recordings. (Stuart, 2008, 1-5)

Here we come back to very basic differences of analogue vs. digital. As introductory shown, digital is always a defined value (like either zero or one) during analogue has all of those nuances in the middle (to illustrate this, one could say analogue contains all of the small values between zero and one even this is not entirely correct)





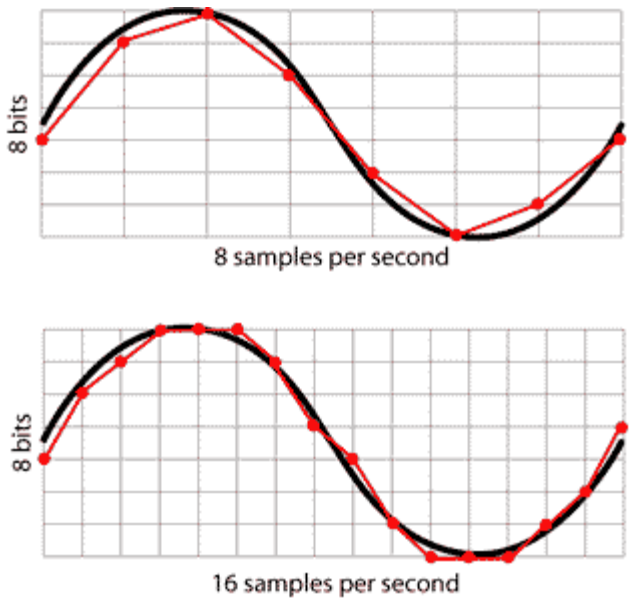
Picture 5: A zoomed in digital wave form - *non smooth* against a Picture 6: visualized analogue wave form - *smooth*. (Schneider, 2009)

The pictures show the differences between a strongly zoomed in digital and analogue wave (the overall difference in shape carries no importance). The analogue wave is only a projection to illustrate the actual difference. Analogue waves are not visible as such on a computer screen as only digital content can be visualized on such digital organs (however analogue sound waves can be made visible by so called oscilloscopes within certain boundaries). At a very high zoom level the analogue wave is always smooth as it does take on all values unlimited how small. The digital however wave is restricted in doing so by its computational framework. As indicated the digital version uses samples to reproduce the actual sound captured. The more samples (higher sample rate) are used the more precise the sound will be. Still in theory it can never fully reach the original analogue sound quality only try to get as close as possible. Applying this once more to the mosaic. It would mean to put an incredible high amount of tiny stones into the mosaic. In the end it would probably look very close the original picture but never a hundred percent alike. Each stone would still have its borders unlike real nature, where everything flows into each other without any such borders. This is the reason why many professional studios still use analogue oriented equipment or many people rather listen to gramophone records instead of CDs. The final audio quality is still better.

Earlier I stated that everything we hear is analogue. So how is this possible in respect to the previous mentioned? At the precise moment that a binary – digital file is played by for example the computer, it is being transformed into

analogue signals (the movement of the speaker membranes makes the sound). Any missing value (gaps in between zero and one) is filled in by reconstruction filters (among others) that make up the missing parts so the overall impression is a smooth analogue sound derived from digital storage. That is the reason why the quality is proportional to the digital resolution. Because the higher the resolution the smaller the “gaps” and less needs to be made up from the reconstruction filters (resulting ultimately in better sound).

Nonetheless the general professional working practise is more complicated whereby continuous transfers between analogue and digital (possibly multiple times) occur. To discuss such techniques is beyond the scope and meaning of this thesis.



Picture 7: The higher the sample rate the better the quality. (Wisconsin University, 2009)

2.2 Change of approach in audio creation

As I showed analogue is either everything in the instance we hear or audio data stored on analogue devices such as tapes and records. Before there were any means of manipulating audio digitally everything had to be done analogue. This means that there were two possible options if any audio engineering or altering was to be done to a record. Either to do it during the actual live performance or to first record it and alter it afterwards by rather difficult means. The first option would obviously only allow a single try to get everything right while the second option would store all audio material on tape-like devices. This implies that the audio stored (for example on tapes) would later have to be “wired” through desired effect machines in order to alter it accordingly. But this method would require rerecording it on another device with the changed effects implemented (for example reverb and EQ etc). There were no other direct ways to change audio immediately keeping it on the same medium while doing so. (Tischmeyer, 2006, DVD)

It is easily understandable that a sound engineer would really require good planning to record for instance an entire Big Band. It is obvious that real problems occur when some instrument would share the same recording track. Any change to this track would change all instruments on it equally. That is why it could make it very difficult at times to really only adjusting one instrument. Later available multi track devices have been developed to ease the sound engineers work. At that time usually only larger studios would have had all the equipment available to undertake more sophisticated multi track recordings. But it was basically impossible to visualize the track in any way. Everything was done entirely by ear. When a mistake occurred and needed to be edited out the engineer would have to equally do it by listening and either cut a part or re-record it to another device for further transfer and so on.

Since the revolution to digital audio all of those problems disappeared. Suddenly it was possible with a single computer and an audio interface, or mixing desk to record an entire band with the “luxury” of only one instrument per track. And further even more important: everything could be visualized with appropriate audio programs. That means that with only a few mouse clicks audio could be altered with effects or cut and moved in any way possibly wanted what before might have taken from several hours to a few days. With the move from analogue to digital came a complete innovation of tools and new ways to work with audio. Nevertheless sound engineers of the last generation argue that this step forward, while certainly an ease, simultaneously brings out a lot more people that venture in fields of sound engineering with very little knowledge or competence contributing to a decline in quality. There are complaints from professionals that many new generation sound engineers as well as musicians have a much more sloppy approach to

"get the recording right the first time round" derived from the ease of amazing editing possibilities. (Tischmeyer, 2006, DVD)

Yet another great related improvement for the audio world appeared with the evolution of digital computing: instrumental samplers and synthesizers. I will only discuss samplers in this thesis as similar characteristics can be applied to synthesizers (unless mentioned). As well samplers are probably lesser known but have a huge impact in particular in modern composition as explained later on.

Samplers are electronic musical instruments that use pre-recorded sounds to be played at live performances or implemented in existing projects. Even though first samplers already existed as early as 1960 basically as altered tape recorders the technology only really took of after a digitalization was indeed possible.

The benefit is obvious as unlike their closely related synthesizers (that create sounds from scratch and utilize synthetic sound) those modules will have a somewhat natural touch depending on the pre-recorded audio. It enables musicians, composers, DJs, producers and alike to use those samples and incorporate them into their own projects. The first digital samplers appeared around 1980 and from then have undergone an immense development that is still very much ongoing today. While hardware samplers are still being produced the rise and development of software samplers within the last decade is colossal. The functionalities and sound capabilities have increased dramatically.

Major orchestras all over the world started having their own sample libraries recorded and sell those in packages with software to customers around the globe. The most prominent is probably the VSL – Vienna Symphonic Library (vsl.co.at) with a 9200 Euro purchase price (as of May 2009) for the entire range of orchestral instruments:

*In early 2006, the dream of the Symphonic Cube finally came alive. After **six years of recording** and software development, this **550 GB** magnum opus has set the highest standard for professional composers.* (Vienna Symphonic Library, 2009)

And there are a dozen more with various offers and a range of recorded instruments anyone could possibly imagine. It reaches from subtypes of Chinese ErHu over Scottish Highland Pipes to traditional African chants. And every year there are more libraries being produced with increasing quality.

Picture 8: One of the leading software sampler currently on the market Kontakt3 (Schneider, 2009) and Picture 9: AKAI S1000 hardware sampler (SoundOnSound, 2009)

For completeness I will introduce a still very recent technology in sampling in order to display the vastness of this side of the music industry. Despite all the sampling and increasing quality a certain problem always seemed to exist. And this was to record vocals – in particular choirs. Certainly it was sheer impossible to record every single word in every pitch for every choir section. Most libraries would attempt to cover at least basic vowels like “ooh” and “aah” in various articulations and combinations so composers could use at least those as backing vocals. Nevertheless it only seemed to be a matter of time until this problem was overcome as well. And indeed it did. In February 2005 a company called EastWest (www.soundsonline.com) released a Choir Library called “Symphonic Choirs” that would allow the composer by use of a so called “Worldbuilder” program to enter text to be sung by the choir of choice (Male/Female/Mixed/Boys). And in fact it works very well. The renowned UK Future Music magazine commented about this library:

The Symphonic Choirs package is a true breakthrough product that will forever change the way that producers work. This is not an ordinary sample library but a highly realistic and expressive vocal instrument that ushers in a new era of creative power. (www.filmmusicmag.com, 2005)

With those tremendous tools at ones disposal creativity has literally no boundaries. Anything can be done with the sounds of real orchestras or far away never heard of instruments and even articulated words of choice sung by a virtual choir with astounding quality and precision.

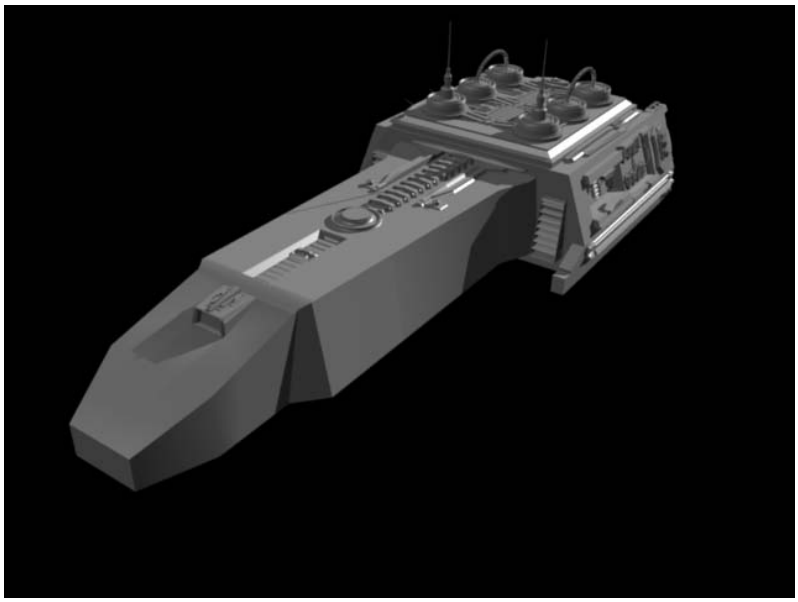
3 AUDIO CREATION PROCEDURES IN MULTIMEDIA

Introductory I clarified that sound and music are both parts of audio when comprehended under the scope of multimedia. Yet the working procedures may vary according to the target project. This section will outline how audio content is created contrasting a movie to a video game defining two currently very prominent forms of modern multimedia. A movie will need a different approach for its musical score then a video game. Equally the sound design will have to be created and in particular implemented in various ways.

3.1 Modern workflow

3.1.1 Music

When talking about the musical composition for a movie it is common practise that composers start working with a rough cut (often called work print) of the film. This enables the composer to already start adjusting the score as close as possible to the final version in terms of musical layout. This minimizes additional time after the movie has actually been completed. Nonetheless the exact timing can usually only be done with the final version of the movie. The work print may often have scenes unfinished while other scenes are still being shot and implemented. Nonetheless in modern fiction movies this first version can often have pre-renders as placeholders that are created as 3D models with the appropriate programs. This then allows for the timeline being already exact what in return enables the composer to finalize the score as much as possible. Such procedures are only possible with the help of modern computer technology.



Picture 10: This is how a possible work print shot from an unfinished “space movie” could look like - created in a 3D graphic software (chrizo.com, 2009)

The director or producer will certainly always engage into conversation with the composer about what music should be used. This procedure of agreement is called spotting. With the help of modern technology many composers nowadays create the entire score in the computer. It is often orchestrated and pre-recorded via sample technology and upon approval (including optional changes that may go through several cycles) from the director recorded with the actual orchestra. During this process the conductor (often the composer himself) can usually see the movie on a screen while conducting in order to keep time with the picture. Other synchronisation methods would include click tracks that change tempo as predefined to assist the conductor. (Karlin, Wright & Williams, 2004, 33-37)

Every so often directors prefer to use a temporary recording of already existing music before they implement the composer's final score. It underlines scenes while the movie is still in production. At rare occasions it happened that the director will later disregard the composer's and instead instate the original temporary music as the permanent soundtrack. A famous example of this is Stanley Kubrick's "2001: A Space Odyssey". Kubrick used primarily existing classical works of major composers and later decided to actually keep them instead of including the score by Alex North as originally contracted. Therefore the music of Richard Strauss, Johann Strauss and György Ligeti among others found its way into the final version presented to the audience. (www.mfiles.com, 2001)

A major characteristic of movies is their linearity as discussed previously. Evidently the music needs only to be linear as well. All cues, once synchronised with the timeline, are fixed. This pattern does not apply to video games which are nearly always non-linear. Hereby the user interactively controls the timeline and major cues while progressing interactively by himself through the overall timeline.

This special case re-determines the techniques and approach towards the entire compositional work. Whereas most of the basic technological implementations on how to create the music (for example the advanced usage of samplers) mainly stay the same. By writing the music the composer is confronted with a position that virtually allows any situation to happen inside such non-linear content. This concludes in particular to modern video games with an immense amount of user interactivity.

Self-explanatory examples could be any situation in which a slow and calm condition suddenly changes into a fast pace, action oriented scenery. In game environments events can only be predicted in the way that they are happening but not when exactly they are happening because it is usually up to the users (player) free will at which point he/she enters the outlined scenario. This

complication becomes even more severe when the function of the music is supposed to change for example from background to foreground.

Another problem is continuity. Compared to music in film that always has a beginning and an end – therefore a constant length – music in non-linear content mainly needs to be infinite. Meaning that the music must be able to either loop or be possible so generic that it naturally can be replayed over and over again with the subconscious consent of the listener. This can easily be exemplified: A game is played where the user is a character in a fictive world. The majority of the game, during “normal” (no key events such as action etc.) time background music can be heard. Upon not attending the game for any amount of time (for example while receiving a sudden phone call) the game state will not change and neither should the music. It is still supposed to continue equally as if the game was played. This means it must loop or repeat as explained earlier. (Captivating Sound, 2009)

Therefore it does not matter what the composer will try to anticipate in his music. Problems will derive with certainty in terms of key, chord progressions, pace and melodic content only to name a few.

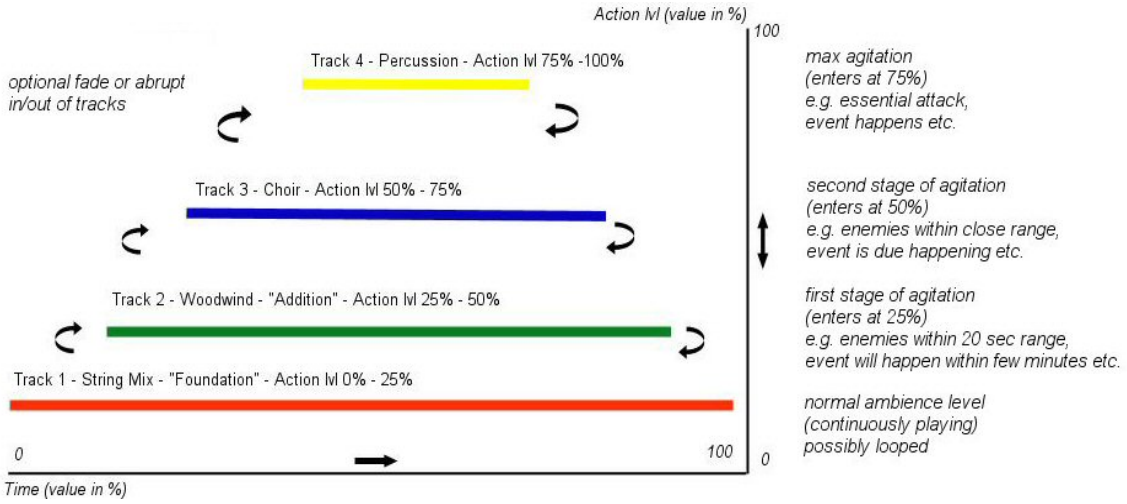
So what are the techniques used to solve those problems and make the music flow as originally thought of by the composer? How can the music and changes in the music be bound to certain in-game events (or other non-linear content)? Up until only a few years back such downsides appeared to be very difficult to solve. The attitude was primarily to use a few tricks to overcome such issues as good as possible. The majority of game and interactive media developers implied the option of fading music in or out according to the scenery. When a change of mood needed to take place drastically one piece would fade down during another one would fade up in a matter of seconds. Naturally this would result in musical problems. A generally wrong sound with no musical transitions could often be the case. However more recently, through further refinement, new techniques arose that would allow composers to actually pinpoint such changes in game play and assign musical cues in a much more precise way than ever before. This was the beginning of interactive music.

So called “audio sound engines” that are utilized as “middleware” in large interactive development projects are becoming the solution for the previous mentioned restrains. Middleware is software that connects other software components or applications functioning in principal like a pipeline. In this case it enables the computer to understand certain events in non-linear content and react accordingly with the help and instructions of this particular middleware. Currently the most prominent on the market are called FMOD, Xact and Wwise. During Wwise is at the moment the surpassingly user-friendliest allowing composers and sound designers alike to edit everything per mouse

click. The others still require a certain amount of programming to be done. While not trying to explain how those programs work (as this would require an entire thesis by itself) I wish to outline how one can actually adopt such tools in order to bypass the constrains of non-linearity. (Porter, 2007)

The main idea following those programs is to deliver an appropriate solution for each alternative reality in regards to sound and music. Once the composer realizes the alternatives it allows him to compose cues for all of them. Over the middleware it is then possible to implement those cues and bind each option to an in-game or other interactive content event. In practise it looks as follows: It is assumed that a player has 3 choices whereas the underlying musical piece can naturally end in 3 different ways as well. Those could be according to the situations for instance harmonic, disharmonic and abrupt. Via the middleware the composer is allowed to implement the main music file with its 3 alternative endings (overall four music files – one main file from the beginning to the cue and three files exactly from the cue to the ending). According to the game event and the player's choice the middleware will "pick" the correct file and play it later in game (what essentially happens is more complicated but the outcome and file input is basically the same).

Yet the composer has other interesting choices: It is possible to have natural fades in any music progression. This means that even *single tracks* (meaning single instruments) of a piece of music can be faded in and out according to certain moods. In real world application one could take out the percussion and only fade them in when an agitated state is required. More options include other alterations such as speed and volume. To culminate this even further, the composer has the option to overlay entire pieces with each other. This would usually be two or more emotional contrasting but musical matching styles that can fade alongside each other as required. This composition style in particular finds increasing application whereby it is obvious that the composer must be very skilful in order to accomplish such, one could say, "trickery". This is defined as *interactive music, layered composition technique* that indicates where current development is accelerating into.



Picture 11: This is how a possible very simplified layered track sketch for a game could look like triggered interactively during an actual game. (Schneider, 2008)

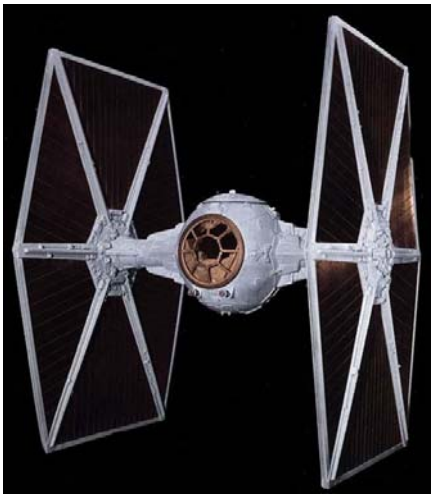
3.1.2 Sound

Sound effects as a category are substantially subdivided into four different groupings: First of all are the so called *hard sound effects*. Those are sounds that appear on screen and are synchronized to the picture. The sounds are recorded directly as what they are in every day application. An example would be for instance a door slam.

Foley sounds equally synchronize on screen but opposing to hard sounds are usually not the original sound as what they appear to be. That means that they are recorded and mixed to appear as another sound on screen. An example is to break frozen celery to imitate the crushing of bones. Professional Foley is usually done by specially trained Foley artists and is commonly seen as an art in order to come up with ideas what sounds would imitate the according picture appropriately.

Background sound effects are all sounds that indicate ambience settings. They do not need to be synchronized to the picture. Ambience sounds are usually recorded in real life application in nature and then mixed together. Nevertheless they can include design sounds for example for rather fictional settings. Common background effects would include weather ambience and forest ambience etc.

Design sounds describe a palette of sounds that usually do not occur in nature (for example a laser weapon). Such sounds can therefore not be recorded directly. They have to be created from scratch with various audio editing tools and with the help of effect processors. Often such sounds can be found in science fiction related content or as underlying “music” to support emotional moods.



Picture 12: The sound of a TIE fighter is “a drastically altered elephant bellow” Ben Burt – Sound designer on the movie Star Wars. (Star Wars Wikia, 2009)

Similar implementation procedures apply also to sound as they do to music in both genres - film and game. In film there is ultimately one static audio track which will carry the pre-recorded and synchronized sound effects matched to the linear picture. In games (or other interactive media) each user activity, environmental events and every sound able object needs to have one or more defined sounds “attached” to it that then can be triggered at the corresponding moment of action. All of those sounds are each usually a small and short sound file that traditionally have been implemented via the games program code. However nowadays sound designers and audio programmers equally use middleware tools in order to expand possibilities and to ease rather problematic programming procedures. New features include 3d positional sound capabilities, ambience corresponding nature effects (for instance the reverberation of footsteps in a cave environment) and random choice of sound data (the computer is able to picks sounds randomly from a pool of possibilities e.g.: bird sings in variations instead of using same sound over again) among many others. The development here clearly indicates a further increase in ingenuity pointing for example at the area of wave field synthesis that will ultimately enable people to have an audio experience as if being directly inside the happening.

3.2 Crossing of knowledge boundaries

It is coherent that the constant improvement of modern digital tools allow for faster and easier working procedures than ever before. While previous traditional job descriptions appeared to be clearly defined roles reaching from the score copyist over the Foley artist to the composer, modern day digital computer techniques allow, and often even require, becoming anything in between or a combination of many of those formerly separated experts. This leads to achieving a specialization that until recently would not have been recognized or known to exist.

While originally the entire audio creation for film (including the music score and sound) would require at the least a composer, an assistant for further orchestrations, a copyist, a music editor, a mixing engineer, a recording engineer, a Foley artist, a sound designer (etc.) modern setups can vary immensely. Only very large multi-million dollar projects can nowadays effort to employ a crew of more than five people for the audio part not including any musicians. But as the majority of modern multimedia work is conducted on medium or lower budgets the expenses need to be narrowed down.

The resulting point at issue is that an increasing number of people is needed who, while still being experts, require an overall broader knowledge and primarily new set of skills compared to a few years back. The games sector is a clear example of this pattern. Traditional job descriptions began to merge into each other and have created a commonly recognized three folded skill system of industry experts. Those are namely sound designer, composer and audio programmer. While the audio programmer is a relatively new job title, the sound designer and composer definition has changed drastically.

The modern sound designer will in most cases not only be responsible for the creation of all four previously discussed sound categories (that before may have been assigned to several people) but has preferably knowledge of composition, recording techniques, three-dimensional audio placement and scripting (scripting = low level programming skills) as well. A current job description for a senior sound designer states the following under desirable knowledge and skill requirements (those are additional to the essential skills):

- *recording techniques*
- *microphone placement*
- *Foley sound creation and on location recording*
- *scripting/simple coding*
- *composition ability*

The original sound designer becomes a multifunctional sound technician and recording engineer that can also compose and even program and understand some basic code. (Job advertisement at Gamesindustry.biz)

Similar things can be said about the composer's job. It is not uncommon that modern professional multimedia composers have a solid technological education. To some degree it became their task to know well how to mix and master audio and even handle basic sound design and recording techniques. Traditionally only audio engineers and sound designers would posses such knowledge and skills. Additional finesse in complex software (as partially explained earlier) is considered more and more beneficial as time progresses. Many industry composers often have their own professional studio setup that traditionally only engineers would possess and can handle it equally well nowadays.

Audio programmers write software tools and other utilities to support sound and music inside interactive content. Even though working more on the side of programming, audio programmers do need a thorough understanding of audio production and effect processing as well. This is by far the most specialized career path of the three mentioned and continues to increase in demand and pinpoint specialization as systems become more sophisticated in their use of music and sound. (www.igda.org, 2009)

More traditional roles like pure sound engineers, original sound designers and even copyists are still needed and employed. Those are positions reaching from theatres over teaching to studio work. Nevertheless a trend is recognized that increases the need for new generation sound designers, composers and programmers increasingly as outlined previously. That's why it is often common that people derived from a sound design and engineering side call themselves equally a composer while never having had any real traditional music harmony or orchestration studies background. And opposite that composers would call themselves sound designers. This derives from the problematic of increasing pressure to fulfil the need of such multi specialist positions and shows a partially dark side of this entire development. Previous clear defined roles can therefore become "wishy-washy" under modern characterization.

The smaller the project sizes get the less budgets are available and the more condensed the requirements often are. Job description that would in some sense unify a composer, sound designer and programmer position have actually appeared. In particular smaller development studios that wish only to employ one person responsible for audio due to their budget restrictions struggle to compete with larger studios that can provide an own audio department with 5-10 people.

Therefore smaller independent studios have emerged over time. Those are specialized on outsource work and can focus only on music and sound assignments contracted by various development studios on project time basis. This applies to all manner of multimedia including film and has become one of the main appearances of professional audio production procedures worldwide – the audio freelance and contract sector.

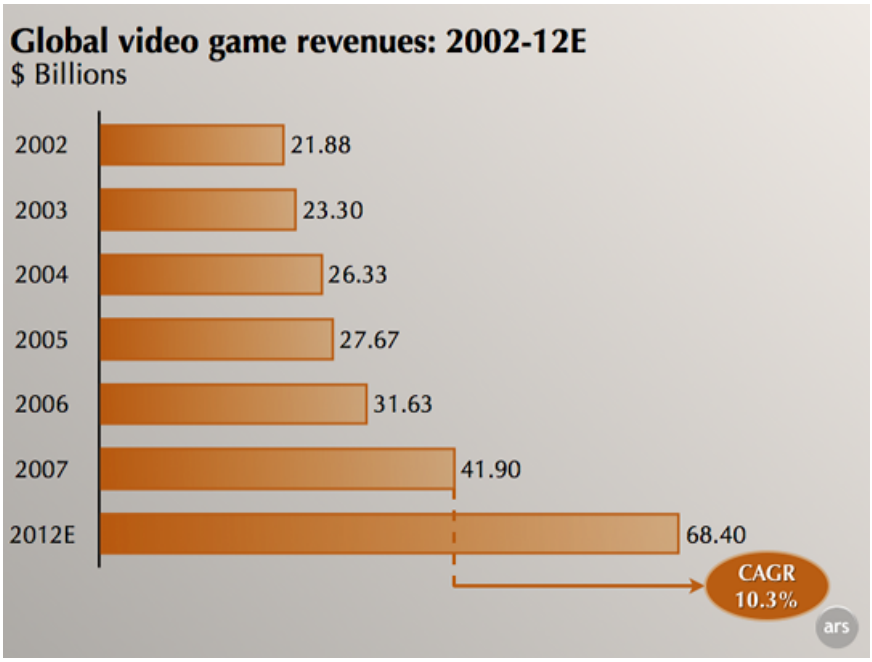
4. POPULARITY AND BUSINESS ASPECTS

"Trust me, if you're working on a $70 million movie and you're the last guy, you feel all that weight on your shoulders," (Zimmer, 2009)

4.1 Accelerating growth as an industry

With the advance of audio into digitalization and next generation development methods newly defined professions arose over time. Demands for a continuously growing know how and re-specialization is mirrored in the advancement in this fast pace growing sector. It does not take a lot of insight to understand the importance of multimedia as a new emerging industry within the global economy. Many companies and countries have recognized the potential of revenue that can be made with modern multimedia.

This can be exemplified with numbers. A report published by PrivatewaterhouseCoopers (a global audit and consulting agency) in 2006 indicated a 6.6 percent annual growth rate for the entertainment and media industry as a whole. According to this report it would therefore reach a 1.8 trillion dollar growth in the year 2010. Nevertheless this is a projection of all major media sectors including Internet, Radio, and Newspaper among others that can only indicate an overall trend. However a study on the video game market in 2008 for the 5 forthcoming years (2012) revealed an annual growth rate of 10.3 percent which supersedes the growth of most other entertainment sectors. Sales are expected to rise from 41.9 billion dollars in 2007 to 68.4 billion dollars in 2012. (Caron, 2008)



Picture 13: Price Waterhouse Cooper calculation (www.arstechnica.com, 2009)

Under those circumstances it is hard to believe that game development has originated as a hobby development by a few individuals during their free-time. The evolution of various multimedia types from its simple origins to multi-billion dollar businesses can be very astounding. And yet it does not stop there. Many other businesses have developed over time as side effects of already successfully promoted multimedia entertainment like video games or films. Those reach from an own advertisement industry, to education and major event management only to name a few. In association to audio in multimedia similar effects occurred. Some as described already in part three (software tool development) and others maybe more peculiar as follows:

The film music magazine (filmmusicmag.com) reported the following about Tadlow Music in an article in the beginning of this year:

London-based Tadlow Music has announced implementation of a full Source Connect remote recording system in Prague for their buyout recording packages featuring the City of Prague Philharmonic Orchestra for rates from USD$23 per hour per musician for film and television scoring.

Source Connect technology allows realtime remote recording by connecting the orchestra recording studio directly to a composer's home studio utilizing the Internet and ProTools plug-ins, eliminating the need for composers and other music team members to travel to foreign countries to supervise the score recording process. (…) (Film Music Magazine, 2009)

This literally means that it is possible to have orchestral sessions as a composer over the internet. The recorded material will then directly been sent over the internet for immediate usage. Such techniques have already been known for a while but not yet utilized on a commercial level like this until very recent. In fact the City of Prague Philharmonic Orchestra is one of the first new emerging orchestras that dedicate their playing entirely to recordings and not performances.

Another example is the so called Composers Collective. While it becomes increasingly difficult as a single composer or sound designer to get a foothold in the industry without a certain set of skills people began collaborating with each other. A statement from their webpage says the following:

The Composer Collective is comprised of cinematic composers dedicated to creating dramatic scores of the highest quality for film, television, interactive and commercial media. We group composers into innovative and productive workforces, giving the film industry a much-needed resource for intelligent music at never-before-seen productivity levels.
(www.thecomposercollective.com, 2009)

Basically several composers work together on one title writing several parts of the music and giving advice to each other during doing so. The credit usually goes then to all of them. A monthly membership fee is charged but the revenue later shared on the amount of work that was put into it by everybody.

Yet another event related to audio in multimedia is very striking, resonating current multimedia euphoria. Two video game composers called Tommy Tallarico and Jack Wall started a concert series in 2005 called “Video Games Live”. It combines a live orchestra performing “video game music classics” synchronized with a lightshow and video footage on a screen.

Picture 14: Picture from a Video Games Live concert. (www.videogameslive.com, 2009)

The concert series has been running continuously every since with a sold out (or nearly sold out) rate of about 80%. More concerts are planned this year and in 2010 and probably further into the future as new music is continuously incorporated into the program. Concerts are held all over the world. However only the main crew is travelling and not the whole orchestra as local orchestras are usually hired to play the orchestration parts. One interesting article related to game music published on npr.org states the following:

In May 2004, a composer named Nobuo Uematsu joined the Los Angeles Philharmonic for a single performance of his most famous work. The show sold out in three days. In fact, there was almost a riot at the box office when people couldn't get tickets. What was the music? Uematsu's soundtrack for the popular video game Final Fantasy. (…) (NPR News, 2009)

4.2 Profit or art? Or *artprofit*?

It is self-evident that the success of corporation based multimedia is primarily business oriented and consumer driven. Therefore the possibility to either compose scores or produce sound effects is dependent and co creative on this very realization of success. Just like any other business. This aspect shows that the cycle of work is based on self sufficiency and does usually not rely on any funding other than from its own reproductive or accumulative sources.

However non corporation multimedia can, and often does, depend on external funding such as government support or donors. But this implies that it is mainly non profit based and will in whatever form it exists be seen as a community beneficial good. Such could be free concerts, computer based interactive learning programs or even independent movies.

But no matter if content is created at home by a single persons hand or at a large corporation under the span of business driven intentions one question always remains: Is multimedia art? Does the definition of “art” tolerate motives of profit?

Films for example; that are yet divided into subcategories count commonly as art when they are non mainstream Hollywood based and therefore independent. Those are then often call art-films. Does this define the other films as non art? Every year prices are being awarded to the best mainstream movies in different categories including soundtrack.

Various multimedia forms have been under question if they could be considered art or not art. Phil Harrison, former President of Sony Computer Entertainment WWS argues that video games are an art form. A view that many avid gamers share:

You can buy a Sunday newspaper in any city anywhere in the world and there will be a magazine insert in it called something like "Culture" or "Weekend Life." And in that supplement you will find excellent writing and reports about film and television and theatre and radio and all kinds of print media like books and magazines, but you will very rarely see games considered as culture or art. That's what I would change. Most games are described in the technology pages, rather than in the arts and entertainment pages. Games are such a widely enjoyed entertainment pastime that it is completely appropriate that they be covered by the kind of high-level journalists you expect to get other cultural reporting from.” (Harrison, 2007)

Audio as a medium in the general multimedia concept is nearly always entirely based on another medium to exist. If there is no film, then there is no music to it. So undoubtedly a connection can be drawn in the arts definition. When a film is not regarded as art then how should we regard its music? It appears that

definitions often are made if a medium is commercial or not. But would the music be more beautiful in either one scenario? Wouldn't the sound implemented still make the same "noises" either way? Surely budgets do play a role in the final quality but with increasing professionalism and better tools even independent movies tend to have large orchestral scores and top notch sound design implemented.

Undeniably it equals an infinite riddle trying to define what art is ultimately made of as there will always be argument about such definition. People might feel that art is for them what appears to be pleasant or beautiful. And yet others would argue that art is what strikes them in any kind of way. May it even be horror and shock. Leo Tolstoy states in his book "What is Art?"

"(…)The feelings with which the artist infects others may be most various - very strong or very weak, very important or very insignificant, very bad or very good(…) If only the spectators or auditors are infected by the feelings which the author has felt, [then] *it is art.(…)"* (Tolstoy, 1896, 51)

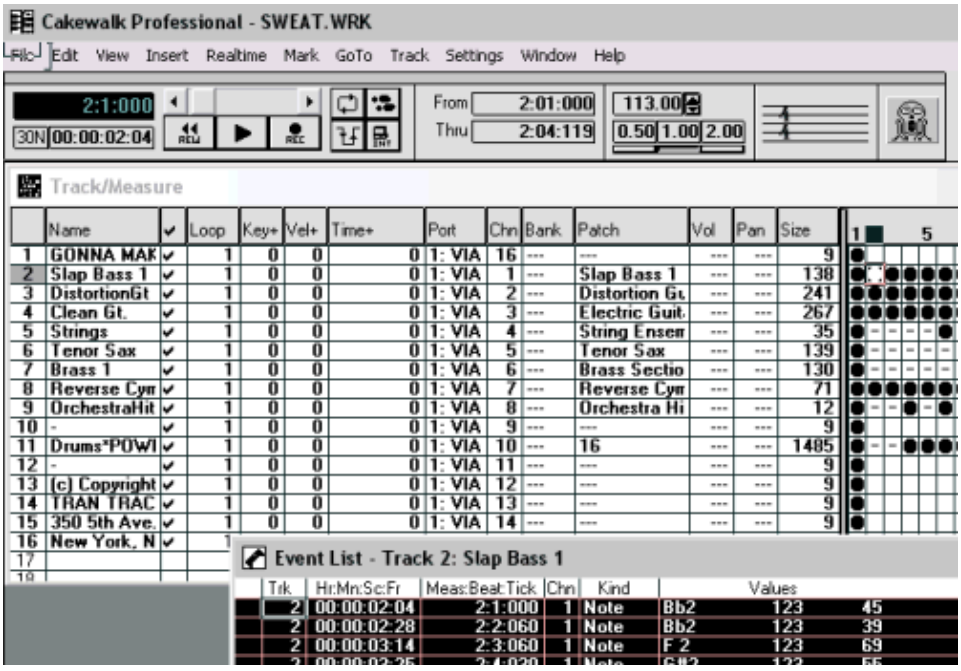
Nevertheless this thesis does not debate about the definition of art or if certain forms of multimedia are included as art or not. It rather points at some of the varied perspectives and opinions available and the resulting controversy. While wishing only to indicate this dispute to the reader it is beyond the scope of this written work to lead any further ongoing argument of such definition.

5 PERSONAL EXPERIENCES AND WORK PRESENTATION

5.1 Background and experiences

I honestly admit, that when I was young and started to play an instrument (at first the recorder and later the piano) I only did this because I was put into lessons by my mother. I still remember actually disliking it as I always had to practise while my friends were playing outside. However later it turned out that I actually started to like it and even began to study saxophone additionally at the age of sixteen and transferred my studies to an appropriate music border school. For my mom's endurance and patience with me during that time I still thank her today.

When I had a first MIDI keyboard at my disposal I was very eager to connect it to the computer and create music with sequencing programs. At that time I used one of the first versions of "Cakewalk" an early ancestor of the modern "Sonar" program what currently belongs to Roland [TM] and is used as a professional sequencer nowadays.



Picture 15: Interface of my first sequencer used for "composition". (www.tweakheadz.com, 2009)

In most cases my musical exploits were not very successful or musical (mainly pop oriented 2-5-1 chord progression) but taught me already a lot about MIDI and computer based composition techniques. Once I started to learn the saxophone I used to make backing tracks for myself on famous tunes and

played the melody alongside the backings. The sound was usually utilized by the keyboards inner synth processor and not yet samples.

Even though samples where actually around already for a while but merely on hardware modules that needed to load each sound bank separately as computers were still too slow to load the required amount of data into their memory. My teacher actually possessed such a device and I still remember the day when he showed me one of his sampled Big Band compositions. I couldn't believe how real the actual sound was. For me it was just something like a pure "magic machine".

Until moving to the border school I slowly grew attached to computer technology and its more addicting side effects: video games. I recall having a Commodore 64 (a basic 8bit home computer) and figuring it out how to make it work and what to do to make games start. One was actually required to type command lines in order to run any kind of software.

Picture 16: Example of the typically blue C64 interface. (www.intelliadmin.com, 2009)

Later a PC substituted those outdated systems and experimenting and playing around with system files became the norm. A rather funny episode shows that during one holiday week we met with my friends and each brought their computer along in order to play games together over network. Rather a novelty at that time. We nearly spend the entire week trying to actually establish a connection between the computers instead of having any fun at all. Connecting several computers at that time could be an incredibly difficult task to manage. It was not plug and play like nowadays.

I do believe that this and many other similar events did allow me and my friends to get very comfortable in using a computer and already understanding early not to be scared of technology and to simply learn by trial and error.

If it was fatal then we would simply reinstall the operating system and start all over again from scratch. However while still writing music and experimenting further with MIDI I always felt that an increasingly study of music enabled me to produce something in return and to enjoy a pleasantly satisfying feeling of creation. And I wanted to understand more.

During my last year in border school I participated in the writing, and performance of a musical that turned out to be such a big success that we had to book the cities main concert hall for additional performance nights and were sold out on all occasions. This was really unbelievable and a very precious gift while finishing my high school time.

Once I began to study music in third level education I realized that I want to absorb more styles and techniques in both, playing and writing music, rather than to focus on only one detailed part. I knew that this would probably prevent me from becoming either a professional saxophone player or a classical composer in the traditional sense as one could hardly master both complexities together. Nevertheless I was very much entangled into learning many different things just out of pure interest. In this time span I have been very fortunate to meet an incredible composition teacher while living and studying in Ireland. Indeed I tried very hard to follow every word of his and never missed a single harmony exercise to do valuing each one highly. Simultaneously I took additional lessons to broaden my knowledge about jazz and other popular music styles.

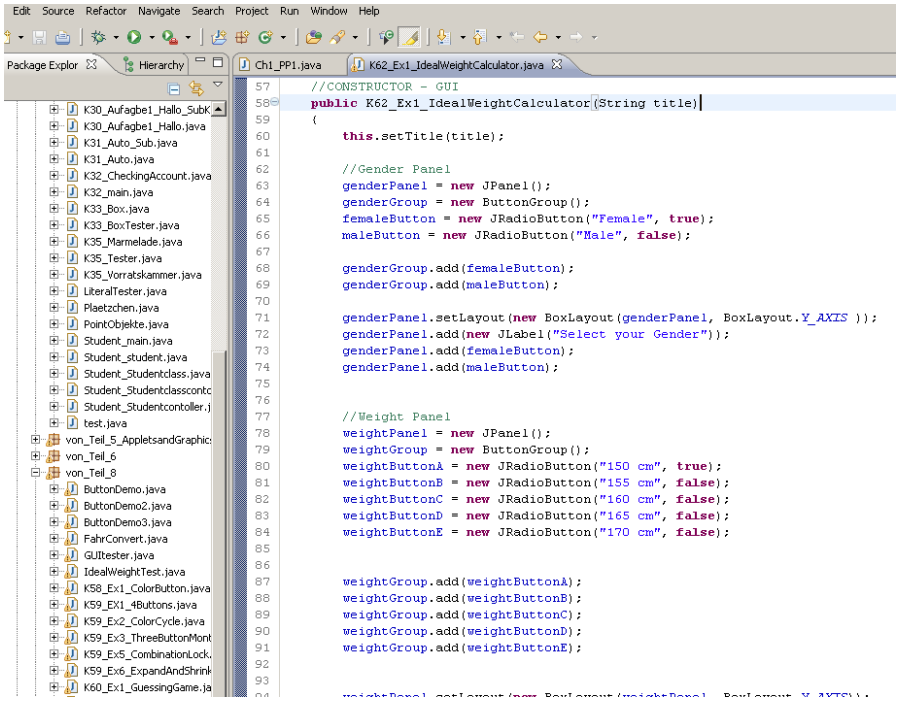
With the transfer to Finland yet again came other opportunities that I enjoyed gladly. I soon became a member of an oriental ethnic music ensemble and a Chinese-Jazz crossover band both located in Helsinki. This extra influence of ethnic music really helped in getting a perspective about world music and its incredible richness. During this period we had several concerts in Finland and Estonia including the UMO Jazz club, the Caisa culture centre and the open stage in Esplanadi paired with a few appearances on Finnish TV.

Naturally I continued my exploration into the field of audio while playing music and studying at the same time. I started to search the internet for possible projects that I could join in. Yet again the video game sector appeared to offer a lot of possibilities on the hobby development front for newcomers that wanted to get experience. I conducted some research and contacted a few independent projects if they would need any help. Fairly soon I became a member of a small development group. While in communication over the internet with the rest of the team I was responsible to compose music for

various in-game events. It was practically my first outsource job working in multimedia. It helped me a lot in getting the experience I needed. Eventually with enough good work done I in fact got promoted to be the department leader overlooking the audio creation and implementing my music ideas.

This made me understand that I should try to reach out more and at the same time increase my professionalism by continuously adding to my knowledge and know-how credibility. I decided to seek out for real jobs in the pro-league sector. I registered with a recruiting agent (what is a very common procedure in the games industry) applied for various positions and soon received message of an upcoming phone interview. I was thrilled and even more so when I heard that it was with Sony CEE in London. The interview and an included test went very well and a few weeks after that I was already in London working from my desk on audio and MIDI for Playstation games. Certainly the experience and know-how gathered there was at another level and extremely valuable. It is really something else to work every day with a team of thirty to forty very talented people on a common goal and project and to be part of meetings to discuss solutions to problems with other common minded people.

Still I did not intend to halt or get too comfortable. In my free time at weekends and after hours I would work additionally in order to continue my music and sound creation efforts next my job. I was constantly on the look out for new freelance projects on the horizon. Simultaneously I got more and more fascinated how programmers in our team, which I would collaborate with every day, could sit down and start writing any software tool they desired. It truly appeared as another power of creation of which the techniques were unclear to me. When I shared my view with them, they would usually laugh and tell me that I could do the same with music notes and they don’t understand how this works neither. This was really a catalyst for me. That is why around this time I also began to study programming (JAVA) in order to broaden my knowledge of development processes and future employment perspectives in the industry.



Picture 17: Example of JAVA programming. (Schneider, 2009)

Stating all of those experiences I want to express that even while they often appear to be very contrasting I believe that each of them functions like a puzzle piece in a jigsaw completing the overall picture. While there is always the danger of knowing everything a little but nothing really well, in my opinion it is often a matter of interest and curiosity and finding a way to accrue the necessary skills to pinpoint once future goal of interest and therefore become a master in it. I remain confident towards things that I still need to get to know but humble towards things that I already do know. This enables me to continuously learn out of interest and accumulate the required knowledge over time.

In particular through my work in London and all its related aspects I realized that success is not entirely bound to what one knows but how one handles the knowledge appropriately in the required context. And much knowledge is ultimately accrued through work. I saw former programmers become producers or artists become managers as they absorbed appropriate information over time. Simply the need for a newly defined and continuously changing workforce often allows employees to put themselves in such context of evolving skills and therefore have a career they choose to have. Nevertheless it is clear that pros and cons will equally appear in such situations. However to discuss those accordingly is another topic and would exceed the frame of this thesis.

Currently I continue my studies of programming with increasing pace and professional aim and venture deeper into the field of audio engineering, effect processing and program related control of audio data while still ever nurturing my abilities to compose and create. If one wants to work in multimedia it is crucial to be very versatile in music and accumulate a number of skills as presented previously.

5.2 Personal work presentation

Accompanying this thesis is an attached CD. All files discussed can be found on there appropriately. All video files are in avi format and audio files are in mp3 format. I recommend the VLC player for playback that can be downloaded for free over the internet. (http://www.videolan.org/vlc/)

5.2.1 Videos

The two files called short_animation 1 and 2 have been created as a small show reel project of Stefan Wohlgemuth. He is a designer and video editor and we have been former colleagues on a development project. Stefan asked me to write short audio clips supporting each animation scene.

Short animation 1:

It is made after a model of artist and architect Erwin Heerich who is known for his orthogonal works. It demonstrates camera movement and the general rendering.

Stefan basically wanted me to keep up an interest in this video and not to have “boring” music in the background but still generic. The camera movements had to be supported by a sound. I have simply used reverse cymbal for that. In a compositional sense I wanted the music to build up onto the first camera movement and use the time before that (beginning to 0:11) as a natural “build up” introduction. The music was entirely created out of samples and synched to the video appropriately in terms of tempo.

Short animation 2:

A time lapse exemplified on a plant morphing is the topic of this short animation. The version presented here is a temp. That is why the music is ongoing as opposing to the still to be made final cut.

When I first saw the first premade version I immediately thought of the possibilities to implement an oriental sound inside. I presampled an egyptian oud with the rest of the track and later asked my friend Aladin Abbas, whom I played with many times before, to rerecord a rather free feeling track on top. Finalizing I cut all the available audio material and adjusted it accordingly to the picture (e.g. leaves flying away). Additional rough wind sound effects that I have implemented last helped to create the desired athmosphere.

Uganda documentary clip:

This is a short clip of a documentary about the expulsion of the Ismaili community in Uganda during Idi Amins regime. Aleem Karmali, the director of Crescent Productions and personal friend of mine asked me to write the score for this 26 minute documentary. We have collaborated together already in the past. This production was in cooperation with the Institute of Ismaili Studies in London.

The included clip is a copy of the work print. Therefore the quality is very low including the implemented audio. I copied the original music track into the music folder. The main issue throughout the documentary was to support the moods and notions as appropriate as possible. It is a very challenging task at times. We have been corresponding continuously with each other about many small details and numerous changes throughout the production. The documentary is currently in the final stages of post production.

Western style movie clip:

Based on a western style bar scene I composed a short score for this independent film project (current still in production). With the music I particularily tried to follow the flow of the main characters movement and increase the tention towards the sheriffs and deputys arrival in the scene. Up to this date the music has not yet fully been implemented. I did create the music but not the other audible sound effects in this clip.

5.2.2 Additional music and sound effects

All music files on the included CD are various compositions of mine that have either been used for media or hold the purpose of show case compositions. I named the files accordingly to their original aim of implementation settings. With this I wish to add to the previous video part and deliver a few more samples of work. It is ought to also complement the previous thesis subsections and showing some of the explained techniques as well as technology in action.

About the file naming as on the CD: Film indicates that the music would have been written for film or similar screen picture. Game obviously indicates a gaming related background. Whenever the music has predominant themes it is indicated by “thematic”. Those are tracks commonly used in the foreground. A rather “ambience” setting indicates a background use whenever appropriate. Nevertheless ambient pieces can inherit subtle thematic tunes while not catching too much attention from the listener. Only one track is marked as “generic looped”. It indicates that the file, while having a very generic and repetitive approach to its composition, can be looped infinitively. As previously explained this is often required in gaming environments. Nevertheless also movie producers tend to use such music as it allows them to keep the music running for as long as they see fit and fade in and out at will. The indication “trailer” shows that those files had a so called story board as they were written for game trailers. This means that they change according to the original picture.

For the purpose of completion I have added two sound effect tracks that I have created previously. I have recorded some of those sounds by myself, in particular the human related noises. The most other sounds originate from free available databases.

6 SYNOPSIS AND FUTURE PERSPECTIVE

While some of the topics discussed in this thesis are likely to be self-evident and self-explanatory others may need further reading in order to entirely comprehend them. However my aim was to show a trend in development of audio in multimedia that has originally been triggered by the digital revolution. Therefore familiarize the reader with the connection between music and computational progress. This advancement in computer technology allows us to enter in never before available means of creation, let it be art or pure entertainment. The scope of engagement into multimedia and its related audio field with all its aspects is a drastically emerging sector that continuously reinvents itself by means never known before. It is striking that the driving force are we, the consumers. With an ever increasing scope of development the definition of traditional work is constantly changing and requires people to adapt to new needs but also possibilities.

Within this sector a crucial aspect of self development is to stay open and yet focused on newly arriving constantly approaching circumstances. Who knows if in twenty years time movies as we know them today are a thing of the past and the audience can actually take part interactively in the outcome of the movie? More and more 3D cinemas are in on the forerun with breathtaking screenings of real appearing scenarios. Maybe someday even at a person’s home TV set?

What the future holds in this field nobody can really foresee. Still trends can be recognized that allow guesses and mild predictions as the multimedia industry as a whole is still strongly in its growing period and some of its industries are only just in children shoes.

Yet the frame in audio specialisation may appear to become increasingly indecisive nowadays. Where former experts operated closely in their pre-educated field modern factors require an increasing adaptation into new media and a multi area commitment. For many people that would have usually not dared to venture into domains of computer science or audio techniques, the field of multimedia with its next generation tools and methods may offer interesting alternatives or at least onward choices of progress and further professionalism.

This thesis introduced basic principles of computation that would ultimately lead over concepts of audio to a display of new tools and ways to allow one to become creative. Several examples showed how current trends apply to a changing market and an adaptation of skills. It is clear that an area like classic music and classic music education is based on long rooted teaching traditions that have developed over many decades and even centuries. Naturally difficulties arise to employ modern audio techniques into such existing

teaching methods at a similar pace as technologies continue to develop. Yet the rapid increase of multimedia usage and new distribution possibilities requires musicians to equip themselves with modern options of articulation in this digital world. *Who wants to be heard needs an appropriate megaphone*.

It is up to the interest and need of each student to further utilize the previously presented knowledge and possibly achieve personal progress with additional reading and study into ones professional future.

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Appendix 1

CD contents

Relevant section	Genre	File
5.2.1	Video	(CD)\Videos\short_animation1.avi
		(CD)\Videos\short_animation2.avi
		(CD)\Videos\uganda_documentary.avi
		(CD)\Videos\western_clip.avi
5.2.2	Music	(CD)\Music\film_ambience.mp3
		(CD)\Music\film_ambience_thematic.mp3
		(CD)\Music\film_generic_looped.mp3
		(CD)\Music\game_thematic.mp3
		(CD)\Music\game_thematic_ambience.mp3
		(CD)\Music\game_trailer1(epic).mp3
		(CD)\Music\game_trailer2.mp3
5.2.2	Sound	(CD)\FX\FX_1.mp3
		(CD)\FX\FX_2.mp3