Drum Programming
versus
Remote Recording of Drums

Master Thesis for obtaining the academic degree
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submitted by
Andreas Winkler

Department for Arts and Cultural Sciences
at Danube University Krems

Advisor: Mag. Dr. phil. Eva Maria Stöckler

Translation from German by Suzette Teixeira

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Statutory Declaration

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Acknowledgements/Dedications

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Keywords:

Drums, Music Programming, Remote Recording, Sample Library

Abstract

Today the production of drum tracks is often done by computer programming or the actual recording of a drummer in his studio, called Remote Recording. The aim of this master thesis is to compare Drum Programming and Remote Recording and perform an analysis of the strengths and weaknesses of Remote Recording and Drum Programming, taking into account the working environment and daily routine of the composers.

In the production of a drum track the results obtained depend on a number of factors for both sample library programming as well as Remote Recording, some of which are related to each other. These are, on one hand, the composer's programming skills and quality of the library used and on the other hand, the quality of the musician and his studio. The results depend also on the available time budget, the financial budget for the production, the genre of the composition, the likelihood of subsequent changes and a few other parameters.

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Die Produktion von Schlagzeugspuren erfolgt heutzutage oft mittels Programmierung am Computer oder durch die reale Aufnahme eines Schlagzeugers in dessen Studio, dem sogenannten Remote Recording. Das Ziel dieser Masterthese ist es, Drum Programming und Remote Recording gegenüberzustellen und eine Analyse der Stärken und Schwächen von Remote Recording und Drum Programming unter Berücksichtigung des Arbeitsumfelds und Arbeitsalltags des Komponisten durchzuführen.

Bei der Produktion eines Schlagzeug-Tracks hängen die erzielten Ergebnisse sowohl bei Sample-Library-Programmierung als auch bei Remote Recording von einigen Faktoren ab, die teilweise miteinander in Beziehung stehen. Dabei handelt es sich um Programmierungsfähigkeiten des Komponisten und die Qualität der verwendeten Library einerseits bzw. die Qualität des Musikers und seines Studios andererseits, um das zur Verfügung stehende Zeitbudget, um das finanzielle Budget für die Produktion, um das Genre, in dem komponiert wird, um die Wahrscheinlichkeit nachträglicher Änderungen und um einige andere Parameter.

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1. Introduction

Due to the triumphant advancement of the computer in many areas of life, the working conditions of the composer have changed. The earlier work equipment were mainly pencil, paper, and usually a piano, the result of the compositional process was a pile of papers. Today things are very different.

"The computer is the main working tool of film composers. It is hard to imagine that there was a time when soundtracks were written without a computer. The main tools were note paper, pencil, stopwatch and a long list of scenes that had to be set to music. Picture and sound first came together after the orchestral recordings, and it was probably for all those involved the most exciting moment of production because no one knew up to that point what effect the music would have on the film."[1] It is currently considered standard that a composer does not (only) produces notes, but that the client receives a finished piece of music that can be directly used in film, advertising or games. Even in the case that this music is only a draft, the required quality of production is very high.[2]

The composer is now faced with the decision to program his music himself with sample libraries, record a musician in his own studio or to book a studio.[3] In recent years, a new opportunity has arisen the so-called "Remote Recording". This works as follows: the composer sends his more or less finished music production via the Internet to a musician. The musician then transfers the track to his recording software, and records in his home studio the following as needed: the desired melody line with violin, backing vocals on several tracks or drum accompaniment. The musician then sends the recorded tracks to the composer, who then inserts it into his project.

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1   Kümpel, 2008, p. 41, translated from German

2   cf. Weidinger, 2011 p. 74ff. and p. 145: "The trend towards" finished demo "[...] always requires a careful treatment of the studio equipment during the layout phase."

3   cf. Weidinger, 2011 p. 93: Hybrid production is often used. This means that for electronically generated music individual real instruments are recorded and added or individual electronically simulations are replaced with real instruments.

As part of my master's program and in conversations with other composers, I have found that some composers are quite familiar with tonal instruments and at the same time have rather little insight into the drums or in its optimal programming. I have been playing drums professionally for over 20 years in various genres, for the past few years I have been working as a composer for Film & Media and operate my own studio. With this combination I have experience with drum Remote Recording for other composers as well as a good knowledge of the work processes of a composer and his requirements. Based on my own expertise and in order to concentrate on the topic, I have observed and analysed in this thesis Programming versus Remote Recording only for drums, but the results are somewhat similar for other instruments.

In the production of drum tracks the results obtained depend on a number of factors for both sample library programming as well as Remote Recording, some of which are related to each other. These are on one hand the composer's programming skills and quality of the library used and on the other hand the quality of the musician and his studio. The results depend also on the available time budget, the financial budget for the production, the genre of the composition, the likelihood of subsequent changes and a few other parameters.

The aim of this master thesis is to compare Drum Programming and Remote Recording and to perform an analysis of the strengths and weaknesses of Remote Recording and Drum Programming, taking into account the working environment and daily routine of the composers.

2. The Drum

2.1 History of the Instrument

The history of percussion instruments is as old as humanity itself. Drums, cymbals and rattles are musical instruments that have been used in all cultures. In the development and the use of musical instruments, magical and ritual needs played a crucial role. "*The intangible and invisible sound has in its volatility something immaterial that is capable of fascinating the world*."[4]

Drums belong to the family of membranophones.[5] A tensioned membrane vibrates the air when hit. In contrast, the idiophones, percussion instruments without skin, vibrate when hit and cause the surrounding air to vibrate. This group of instruments includes cymbals, gongs, rattles, chimes, etc.[6]

In every culture certain drums and other percussion instruments have evolved. Based on this regional evolutionary difference and the preferred use in the respective cultural music, stereotypes can be seen today. Tablas sound more Indian, congas and originate from Cuba, a djembe gives an African flair, taiko drums awake Japanese associations and so on.

The drum-set as we know it today is only 100 years old. Its components are mainly from the small Asian region known today as Turkey, the current Palestine and China's Middle Kingdom. With the Turkish war in the 16th Century, the cymbals and bass drums came to Europe, 300 years prior thanks to the crusades, there were already snare drums and timpani.[7] Drums and cymbals were often used by the military because of their loud and powerful sounds, to strengthen and show the

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4 cf. Michels, 2008, p. 25 (translated from German)

5 cf. Hornbostel and Sachs, 1914, p. 555

6 cf. Michels, 2008, p. 25

7 cf. Fuchs-Charrier, 2001, p. 9

solidarity of the troops. An army marching rhythmically intact signalled order, power and strength, the drums could be heard far and wide.

After the great Civil War in North America (1861-1865) many impoverished military musician traded their instruments at pawn shops. This made it possible for black musicians to cheaply purchase these instruments. They taught themselves to play. Thus, over time many music bands originated from New Orleans. In these – often marching – groups there were at least two sometimes even three drummers. With three drummers, one played the bass drum, the other the cymbals and the third the snare drum. As these bands in the late 19th century no longer played their music for marches and parades but increasingly for dances and concerts, due to cost savings only one drummer was needed.[8]

The development of the drums is accompanied by the development of Jazz. Milestones were the invention of the foot pedal (Company Ludwig 1907)[9] and later the Hi-Hat machine (in earlier times also called 'Charleston machine' because of the frequently played rhythm), which made it possible for the drummer to simultaneously create up to four sounds. Later, the cowbell and woodblocks belonged to the standard instruments. Even later came the successor of the bongos, the tom-toms, to the drums.[10] The 4-piece setup (bass drum, snare, small tom-tom and floor tom) has long been standard up to about the time of the Beatles. Due to the introduction of the electronic amplifier, the size of the concert, the stage and hence, the size of the drums grew. Two bass drums, many toms and cymbals were and still are standard for large Rock concerts. The drums evolved from an instrument which gave the beat from the background to an ever increasing important presence in the music and even more dominant stylistic instrument. Today the setup and playing of the drums are very diverse, even the sound has changed often during the development of music in the 20th century. A Jazz drum-set sounds different to a Rock drum-set or a Pop drum-set in today's

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8   cf. Brand, 1997, p. 18

9   cf. Fuchs-Charrier, 2001, p. 11

10 This standard setup on the recording of the concert of Benny Goodman at Carnegie Hall is lovely to listen to, 16.01.1938. - CD: Benny Goodman Live at Carnegie Hall, released in 1987, Sony BMG - Track 3, Sensation Rag, The drummer is Gene Krupa. The composition "Sing, Sing, Sing" inspired by the invention of the floor tom also shows the increasing importance of the drums in Jazz music.

production.[11] At the turn of the millennium, a small development was observed due to electronic music. DJs played drum recordings faster, the music styles Drum & Bass, Jungle, Trip Hop, Crunch, etc. originated and the drum manufacturers contributed with their new sound ideas (hole cymbals, bell snares, small flat snares, double cymbals ...) their part in the development of the instrument.

2.2 Assembly of the Instrument

The setup of the drum-set[12] is a very individual matter. The various drums and cymbals used and their positioning depends on the drummer and his preferences. Figure 1 shows a drum with a 4-piece Jazz setup (only the drums are counted).

1 Snare drum and stand, 2 Bass drum with foot pedal, 3 Hi-Hat, 4 Small Tom-Tom,
5 Large Tom-Tom, 6 Ride Cymbal, 7 Crash Cymbal, 8 Splash Cymbal, 9 Flat Ride Cymbal,
10 Drum throne, 11 Cowbell, 12 Drumsticks, Mallets, Brushes

Fig. 1: A Jazz drum-set (4 piece setup)[13]

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11 see Chapter 2.3 Setup for Various Genres

12 The following is only a rudimentary overview of how to set up a drum-set, as a basic understanding of the instrument is important for this theme, but a detailed description is far beyond the scope of this thesis.

13 Hofmann, 1981, p. 12, translated from German

The instrument consists of drums and cymbals. The **drums** are in most cases made of wood (Exception: There are also drum-sets with Plexiglas drums mainly for aesthetic reasons). Maple and birch are most often used in high-quality drums. The sound of the drum, assuming it is from a high-quality production, is mainly determined by the type of wood, the diameter and depth of the body. The larger the drum, the lower the pitch, the bass drum has the lowest tone. This is played with the right foot and is additionally muffled.

Particular importance is attached to the **snare.** The Instrument has two heads: the top, or playing head, is called batter; the bottom head, which has the snares (made of cat gut, wire, or nylon) stretched across it, is called snare. The snare drum has a switch on the side which, if loosened, shuts off the snares and makes the instrument sound like a tom-tom. With the snares on the instrument has a crisp, sharp sound and is excellent for playing concise rhythmic patterns.[14]The sound of this drum greatly influences the sound of the musical piece. Therefore, this drum is available in numerous variations in depth, material (steel, bronze, brass, wood) and processing (hammered, anodized, painted, etc.)

The **membranes** were made out of animal skin well into the 70s, today the membranes are made out of plastic. Animal skin has the disadvantage that the stretch depends on temperature and humidity and it also has a short life span. For a touring drummer it was previously often difficult to keep the instrument tuned. If he had tuned his drums in his warm, dry room, the membranes often became during transport through change in temperature and humidity, softer. If the drummer tuned them after setting up then it didn't last very long as the stage has another humidity index and temperature and the membranes will acclimatise. A constant retuning during the performance would be necessary. Plastic membranes do not have this disadvantage. They hardly depend on the temperature and humidity. Another advantage is that today's plastic membranes are already glued or clamped to an aluminium frame. Changing the membrane has become simpler and quicker. A membrane can be changed within minutes. There are numerous varieties of membranes available on the market that can be categorized in single

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14 cf. Adler, 2002, p. 461

membranes, two-layered membranes, with and without muffling and special membranes. The membranes that are stretched on a drum greatly influences the sound. A drum has usually 8-10 tuning screws per membrane, usually one batter head and a resonant head. It is not easy to tune a drum since each tuning screw affects the tuning of each of the other screws. All membranes have to be stretched evenly, it's called 'in tune with itself'. The tone is determined in large part by the tonal relationship between the two membranes.[15]

Besides the drums, the drum-set consists of several different **cymbals**. „*The Cymbal, an old Turkish instrument, is a curved metal plate with a raised cup or bell in the center. The three parts of the cymbal are as follows:*
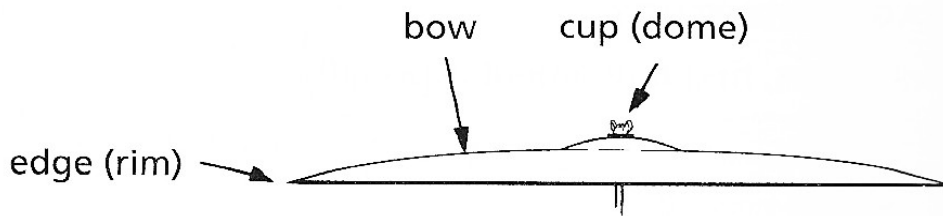
Fig. 2: Parts of a Cymbal[16]

Often a composer or orchestrator will specify exactly which part of the cymbal needs to be struck to create a particular effect.“[17] The cymbals are usually made of bronze. The sound mainly depends on the alloy used, the type of processing (machine or manual hammering), surface treatment, diameter, thickness, curvature and the dome size. According to the size and function Ride, Crash, Splash, China and other effect cymbals can be determined. The Hi-Hat is of particular importance. Two cymbals are mounted mirror inverted to each other, the top one can be moved with the left foot via the hi-hat machine. By varying the angle of the opening many different sounds can be generated.
The drum is mainly played with wooden **drumsticks**, whose shape, material and weight have a large impact on the sound of the cymbals and drums. The shape

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15 cf. Schröder, 2009, p. 13

16 Adler, 2002, p. 452

17 Adler, 2002, p. 452

and material of the tip as well as the weight of the sticks have a direct effect on the sound. The lighter the stick, the softer and thinner is the sound. In addition, mallets, brooms made of metal or plastic, felt, wool or wood mallet, bundle sticks and other mallets are also used.[18]

One can see just from this short presentation that this instrument – the drum-set - is a multidimensional instrument with which you can create a variety of sounds. Furthermore, the one and same instrument can sound completely different, depending on who plays it. "*The individual technique is just as important for the sound as the other factors. [...] The effect of the playing technique on the sound depends on the sensitivity of the movement of the hands and feet, which should not impede the stroke of the stick or the pedal. The accuracy of the beat and how the rebound of the sticks are dealt with has a huge impact on the sound.*"[19] These numerous nuances present a problem when programming with sample libraries, see chapter 4.1.

2.3 Setup for various Genres

As already mentioned[20], drums can be configured very differently. If you would like to create different musical styles then the setup has to be adjusted. Over the years, standards have been developed that require different setups for each genre. This is necessary in order to produce a genre typical sound. It is clear that the definition of a genre typical sound is subjective and everyone has a slightly different opinion of it. This also depends on which drummers and bands of each era one is familiar with. For each statement a counterexample can immediately be found. Nevertheless, some key features were developed, which are universal, for example, no drummer would appear at a Hard Rock Gig with a small 4-piece Modern Jazz Setup. And Nils Schröder, in his book 'Drum Tuning' has provided

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18 cf. Schröder, 2009, p. 24

19 Schröder, 2009, p. 25, translated from German

20 see Chapter 2.1 History of the Instrument

many pages with tips on how to tune drums for the genre Hard Rock & Metal, Rock, Pop, Latin, Funk, Jazz, Punk, Dance music, Hip Hop or Electronic music.[21]

The recording engineer John Pickford writes: *„Take into account the style of music that will be played and the desired drum sound. If, for example, you want a big, punchy rock drum sound you'll need a suitably sized and prepared kit. You won't achieve that sound with a small under-damped jazz kit irrespective of how you go about mic'ing and processing it. Make sure, that the basic sound of the kit is right for the project in the first place, and if it isn't, try to get hold of a more suitable one"*[22]

Here are some examples of possible genre setups:

- Early Jazz: Big bass drum with less muffling, whooshing cymbals, one small tom tom, one floor tom, in addition woodblock and cowbell
- Modern Jazz: Small bass drum tonal sounding (18 inches in diameter), high pitched tom sound (strong membrane tension)
- 70s Pop Music: Many toms with deep shells, short tone because of demounted resonate heads, fat (muffled) and deep sounding snare
- 80s Rock: stadium sound with two large and deep bass drums (22-24 inches in diameter), deep toms, and clear cymbals
- 90s Alternative Music: trashy tuning, often with out-of-tune membranes and objects that are placed on the drums or cymbals placed over each other
- Drum & Base: high pitched (= tightly stretched membranes) snare and usually a second "trashy" sounding snare placed next to the hi-hat

This list can be expanded but it is being used to show that in order to be able to authentically play different styles it is not enough to only have a single drum-set. However, lots of sound variance can be achieved by changing the membranes and applying various muffling and different tunings.[23]

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21 cf. Schröder, 2009, p. 67 ff. and p. 80 ff.

22 Pickford, 2013, p. 188

23 see Schröder: Drum Tuning, 2009

2.4 Demarcation between Drums and Percussion

In this master thesis the drums are being discussed as described in chapter 2.2, not the entire field of percussion instruments. Percussion describes the wide variety of drums, rattles, gongs, chimes, etc., which have a regional origin. A djembe is for example an African instrument, congas originally from Cuba, tablas from India, etc. One can give their composition a regional reference with the specific use of these instruments. To take into account this diversity is beyond the scope of this work since each instrument has typical characteristics with regards to sound production, sound range, playing technique and genre typical usage. And this of course has an influence on the possibilities and limitations of programming with sample libraries. Also with regard to the topic of recording, these characteristics need a differentiated approach.

3. Sample Libraries

Through digitization and the use of computers and sample libraries, it has become possible to electronically produce realistic sounding music. Today, the sound quality of such electronically generated music with sample libraries is already so high that even music experts often cannot distinguish between real and virtual recordings. If anything, one can recognize virtual music because of its perfection.[24]

3.1 Functionality

In order to save a sound electronically and to be able to reproduce it, it is recorded and this analogue audio signal is converted into a digital signal so that the computer can use and edit this. In most cases, a keyboard is used by the composer, which communicates via a MIDI interface to the computer. MIDI is short for Musical Instrument Digital Interface and is an industry standard for the exchange of musical control information between electronic instruments[25]. Each key that is pressed, sends a note value (= which key was pressed, "note on" - command) and a velocity value (= volume), when it is struck, and also when it is released ("note off"). The velocity value is calculated by the electronics of the keyboard from the speed at which the key is pressed or rather from the time required for the key to be pressed. A gentle key stroke corresponds to a low speed and therefore a low velocity, a hard key stroke a high velocity. This "note on" - command triggers the recorded audio sample and the computer plays it with the supplied velocity value. Real instruments don't only get louder with each stroke but also the sound changes. For more realistic sampling of an instrument you need to take multiple samples with several velocities. According to MIDI specification velocity is between 0-127. That would mean you can create a maximum of 128 dynamic levels. In practice, one is content depending on the quality of the library with a few separately recorded dynamic levels.

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24 cf. Lehmann, 2012, p. 20

25 Wikipedia, http://de.wikipedia.org/wiki/Musical_Instrument_Digital_Interface, retreived 5.1.2015

The Vienna Symphonic Library actually tried to replicate with an additional controller, a drum that produces different tones depending on where it is hit. With the help of the modulation wheel it is possible to change the sound simulating different playing areas from the middle of the drum to the edge. Not only single strokes in many different playing techniques and dynamics are sampled but also the particular characteristics of the different playing zones from the drums and cymbals were considered. With ride cymbals the factors such as tempo, play zone as well as the number of strokes that occurred before the required sound are considered.[26] The result sounds very realistic, but is not easy and quick to program. This is an example that it is indeed possible to program drum tracks with high quality but it requires programming expertise and time.[27]

3.2 Quality Criteria for a Sample Library

In order to evaluate the quality of a sample library a distinction must be made of the three categories.

There are sample libraries that try to perfectly recreate the original sound of an acoustic drum-set and reproduce all the nuances of the instrument as realistic as possible. The goal is that the instrument sounds as realistic as possible, as if, for example, a real drummer was playing and not the composer on the keyboard.

On the other hand, there are sample libraries that do not even try to sound authentic but electronically distort the real recorded samples to produce a particular sound. The processing is done in the simplest form with an equalizer and reverb programs, but can also be very complex and produce completely different sounding samples.

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26 Product website (*Jazz Drums VI8D):* https://vsl.co.at/en/Percussion_Complete/Vienna_Jazz_Drums, retrieved 1.5.2015

27 cf. Chapter 6.3.3 Time Budget and Chapter 6.3.4 Achievable Quality

This is also valuable, as certain acoustic expectations have already been established. Interesting thing about this context is that due to the frequent use of sample libraries the audience already expects this special sound for example of an orchestra. *„In some ways it can be disappointing to hear the orchestra try to replicate a well-executed mock-up. The strings especially will have a great deal of presence and impact, particularly difficult to match on heavily accented passages. James Newton Howard describes a typical solution: 'Sometimes I will take sampled orchestral hits and double my orchestra hits and sample marcato strings from my library and double the orchestral marcato strings because people always expect the strings to be louder than they are."*[28]

The third category shows sample libraries whose samples are generated electronically without any signals being recorded. These libraries work like a synthesizer for sound production.[29]

In the first category (authentic drumming) the quality of the sample library depends on the following points:

- How detailed were the various dynamic levels of the instrument recorded, i.e. how many samples were taken per sound with different velocity.

- The general technical recording quality. This includes the quality of the microphones used, the preamp and analogue/digital converter or the entire signal chain from the positioning of the microphones to the finished sample.

- The sound of the studio in which the recording was made. This contributes significantly to the sound of the instrument. One and the same drum-set will sound differently in different rooms through the influence of the ambience in the room (= the sound reflections from the walls, floor, ceiling and objects in the room). Therefore, renowned sample library producers record in famous

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28 Karlin, 2004, p. 371

29 The company Simmons has used since 1980 this type of sound generation for their legendary Simmons e-drum kit, cf. http://simmonsdrums.net, retrieved 1.29.2015

studios such as Abbey Road Studios, and sometimes integrate this in the title of the library, for example, "Abbey Road 60's drums".[30]

- The digital resolution of the sample. The bit depth describes the acoustic resolution of the sample. A bit can take the state 0 or 1 with each additional bit, the signal's acuteness is multiplied by a factor of two[31]. The sampling frequency determines the maximum recordable frequency, this is half the sampling frequency. The hearing range of the ear can reach up to 20 kHz, therefore a sampling rate of 44 kHz is sufficient. Since the signal is processed with the computer the end result can have benefits when recording with a higher sampling rate. Standards are 16 bit/44 kHz or high resolution with 24 bit/96 kHz.

- Number of microphones used. A high-quality sample library offers along with the recorded sound with close miking (also called direct miking), recording with room microphones and other positioned microphones (e.g. Dekka Tree microphones on orchestral libraries). These recordings can be directly mixed together in the sample player[32] as per the wishes of the composer.

For the second category (electronically altered samples), these points are also valid but not in the same intensity since the sound generated after processing has the most importance. This can also more or less deviate from the source.

In the third category (electronically synthesized sounds) only the sound and eventually the resolution qualify as quality factors.

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30 cf. http://www.native-instruments.com In this series drums are sampled from different decades. So there are two drums from the 1950s, 60s, 70s and 80s and two modern sets. Therefore one has genre typical sounding drum kits at his disposal, for example, to produce music that sounds like the funky music of James Brown.

31 cf. Katz, 2010, p. 63

32 A sample player is a plugin in the DAW that plays the sounds of the library and also offers sound processing capabilities. As a standard for many libraries, Native Instruments developed the Kontaktplayer. cf. http://www.native-instruments.com/de/products/komplete/samplers/kontakt-5-player, retrieved 1.24.2015

3.3 MIDI-Loops versus Audio-Loops

Some sample libraries are equipped with **MIDI loops**. These are pre-programmed short sequences that can be strung together like building blocks in a digital audio workstation (DAW)[33]. In a drum library there are often already good and realistic programmed rhythms, variations and fills available in different styles. This is especially good for technically not well experienced drum track composers who therefore have the opportunity to achieve good results very quickly. How authentic sounding these MIDI loops are, depends on one hand on the quality of the sample library and on the other hand on the quality of their programming. MIDI loops can, however, be easily edited and thus a more suitable matching loop can be generated quite quickly but do not have such a natural and authentic drum sound like Audio-loops.

In order to ensure the best possible authentic sound, many manufacturers offer so-called **audio loops**. They are short musical sequences that were recorded in the studio and played by a good musician. These audio samples are so processed that you do not hear the transition when they are lined up (= looped) together.
In the case of the drums, the composer has with the purchase of an audio loop library, a modular system with many combined and very well recorded grooves that were recorded by a professional drummer. The difficulty here is the ability to find the suitable sample composition. And in comparison to Remote Recording where a drummer plays the entire song without interruption, this method sounds a bit repetitive when listened to closely. The individual sequences are often four bars, sometimes eight bars long but then the very same phrasing, accents and other nuances of the sample are repeated. With Remote Recording, this is not the case, since each stroke sounds slightly different as it is from a live drummer – this makes for the liveliness of the track.

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33 Digital Audio Workstation: This is a software used in music production. It can be used to record and edit audio signals as well as to edit MIDI commands i.e. control the sample library, this is called programming. The most common DAW programs are Logic (Apple), Cubase (Steinberg), Protools (AVID), Studio One (PreSonus) and Live (Ableton).

In this master thesis only the MIDI programming (including the use of MIDI loops) is compared to the Remote Recording. For audio loops different parameters are required for a comparison.

Fig. 3 shows a MIDI loop, an audio loop and a manually programmed drum track in arrangement window of Logic 9.1. You can see the blocks in the loop that are always repeating themselves. In the MIDI tracks (green) you can see the single events that can be edited in the DAW's piano roll[34], the audio loop (blue) shows the waveform of the audio signal. The MIDI loop is repeated every two bars, the audio loop every four bars. The manually programmed track does not repeat itself, similar to the continuous recording of an audio track for Remote Recording.
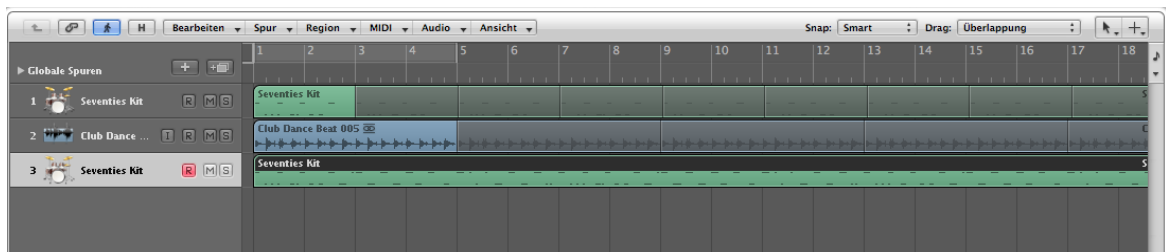
Fig. 3: MIDI-Loop, Audio-Loop and manually programmed drum in the arrangement window Logic 9.1[35]

3.4 Manually Programming versus MIDI Loops

Manual programming refers to the placement of individual samples in the arrangement window of the DAW. In this case, each sound (each drum, each cymbal) is assigned a tone. You can record real-time or step record. In real-time recording, the metronome runs continuously, every time you make an entry, an event is created at this time. It's like an audio recording, what is played, is recorded. In Step Recording the cursor always jumps forward in the program a pre-defined unit, e.g. 16th note when an event is triggered. This has the advantage

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34 see Fig. 7 and Fig. 8

35 source: personal screenshot

that the input events are automatically quantized and the individual notes can be entered quite slowly and irregularly.

3.4.1 Basic Theory of Rhythm

Each rhythm consists of three elements:
- The pulse (corresponding to the perceived tempo of the rhythm)
- The subdivisions (this is the grid where the notes can be placed)
- The melody (usually between bass drum and snare)

The following example (Fig. 4) shows a 16th grid. The lowest notes are on the grid. The notation can be seen above, the lower picture shows the temporal course when which drums or cymbal are sounded.
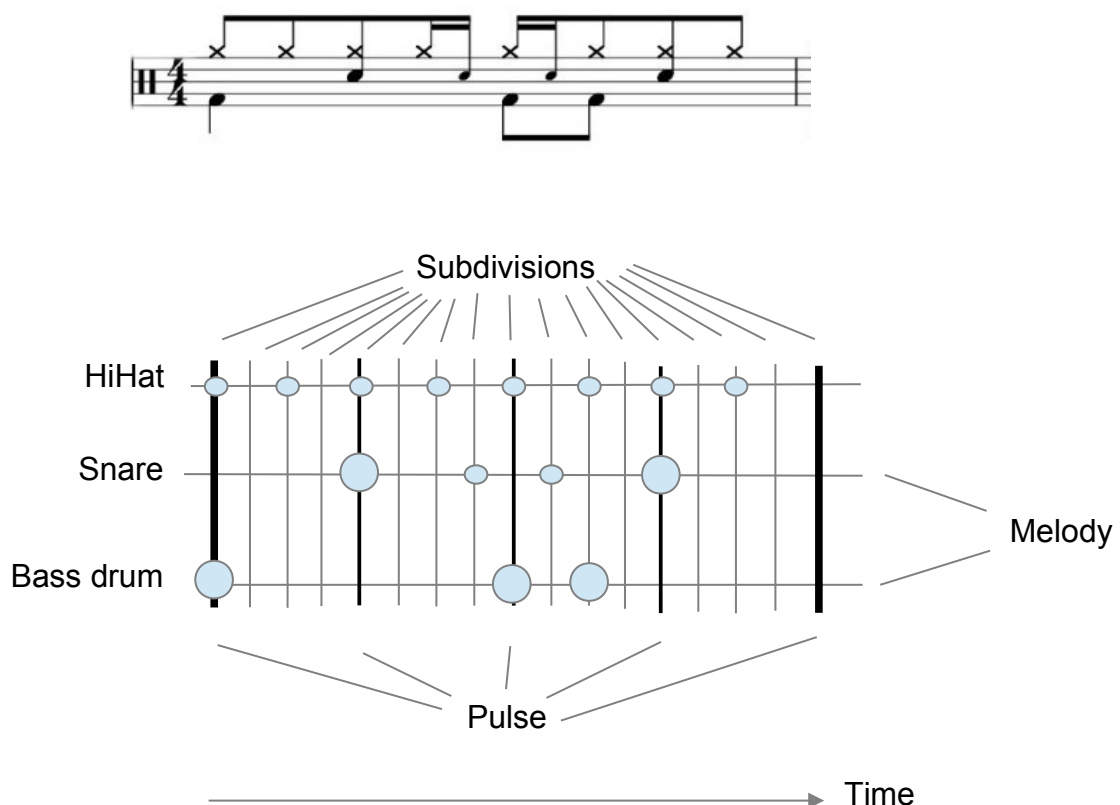

Fig. 4: Elements of Rhythm [36]

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36 source: personal research

Phrasing means the difference in precisely positioning a stroke on the grid, a few milliseconds before or after the beat. If all the notes are on the grid, the rhythm sounds lifeless and as if produced by a machine - they say it doesn't "groove". When a drummer's recording is analysed it can be observed that the notes are rarely on the grid. This happens with a less experienced drummer through inaccuracies that happen by chance while playing. The larger these inaccuracies, the more the rhythm loses "drive" and force. Thus there are fluctuations, for example the snare drum beat on the "2" once forward, another time backwards, just as the drummer hits the drum or the cymbal. These fluctuations are more or less consciously done by a very good drummer but – and this is very important – constant. That means for example that the snare drum beat on the "2" always occur about for example 10 milliseconds after the pulse.

Different styles require different phrasing. Here is a calculated example: Tempo 120 bpm means 120 times per second there is a beat which occurs every 500 ms. In a 16th grid every 125 ms there is a beat. For Rock, the snare is played more or less later, one speaks of laid back, according to the feeling of the song. For Jazz the tendency is to play all the notes before the beat. For Samba, the grid has a wobbly tendency like an egg rolling down an inclined plane (see Fig. 5).
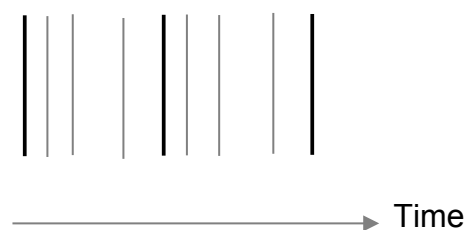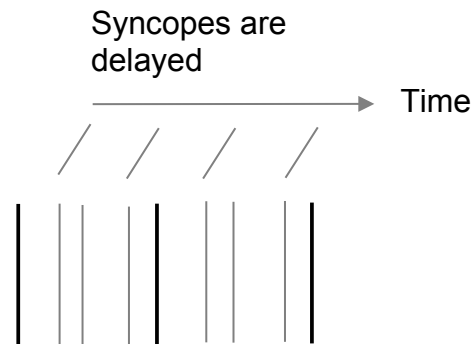

Fig. 5: Samba Grid (exaggerated representation for better understanding)[37]

This is particularly evident even in Hip-Hop. This rhythm is actually a 16th grid but is interpreted as a triplet (this is the adjustable swing factor in MIDI loops) (see Fig. 6).

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37 source: personal research

Fig. 6: Hip Hop Grid[38]

In summary, one can say that a good drummer provides a certain feeling to a rhythm by playing notes before, on or after the mathematically precise grid.[39]

3.4.2 DAW Tools for Programming

The phrasing of the notes is extremely important when programming a drum track. As already described in Chapter 3.4.1, an untrained musician will produce a more random phrasing, making the rhythm loses its force, making it feel unstable.

One of the DAW tools is the **quantization function**. With a mouse click all the notes can be aligned to the nearest grid. The rhythm is now mathematically exact but sounds stiff, lifeless and machine made. Now you can counteract it by letting the DAW generate random variations in phrasing and/or velocity. This is done with the **Humanize command**. The rhythm now sounds more human, unperfected but not necessarily groovier. If you would like to manually program a good rhythm, then you would have to set the notes yourself for perfect phrasing, unless they were already well established. This is a lot of work because many notes have to be edited, and the nuances require someone with experience. Quite helpful are roughly estimated quick interventions such as, to mark all the snare hits on the 2 and 4 of the beat, and move them back a few milliseconds.

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38 source: personal research

39 cf. Davies, Madison, Silva, Gouyon, 2013, p. 497ff

Besides the phrasing the emphasis of each stroke (its volume) is important to how a rhythm feels. For example, does a rock-groove exhibit a strong quarter note puls. With regards to the volume of individual beats, these can be quite good and easily modified with the **Velocity-Editor**. It requires a good drum-set and genre knowledge to achieve the "right" result.

3.4.3 Programming in terms of Real Playability

If you would like to program a realistic sounding drum-set, you have to pay attention to how many and which beats you program. A real drummer has two arms and two legs and therefore can produce up to four sounds at the same time. The right foot exclusively operates the bass drum, and the left foot, the hi-hat. Often a double pedal is used so that the drummer can play the bass drum with both feet. Also, two bass drums (with slightly different sounds) are possible. You have to take this into consideration when programming a rhythm because the computer does not have these limitations. Also, a drummer cannot play extremly fast tempos. And as far as complexity, there are limits, as a drummer can only to a certain degree use (play with) all four limbs independently. In addition there are subtleties that are a result of the movement cycle. A drummer can play three very quick strokes in a row with one hand automatically with a dynamic gradation, either the first stroke is the loudest or the last. Some fast strokes are easier to execute with double strokes on one hand, which sounds different than two strokes with alternate hands.

Silicon Beats, a drum loops and drum sample manufacturing company has a detailed guide for realistic Drum Programming on its website. The important points besides the already mentioned details are: Closing and choking hi-hats, ghost notes, left hand/right hand, choking cymbals, snare buzz, room ambience, simplifying the fills and usage of flams[40]. A programmed drum-set would sound more real if the composer had at least a rudimentary grasp of playing the drums.

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40 cf. http://www.siliconbeats.com/program-drums/, retrieved 29.1.2015

3.5 Programming Equipment

The individual sample events in the arrangement window of the programming software (Logic, Cubase, Protools ...) can be generated in the following manner:

- without additional MIDI devices by clicking directly with the mouse on a specific point in the piano roll (Fig. 7) or in the DAW's drum editor (Fig. 8).
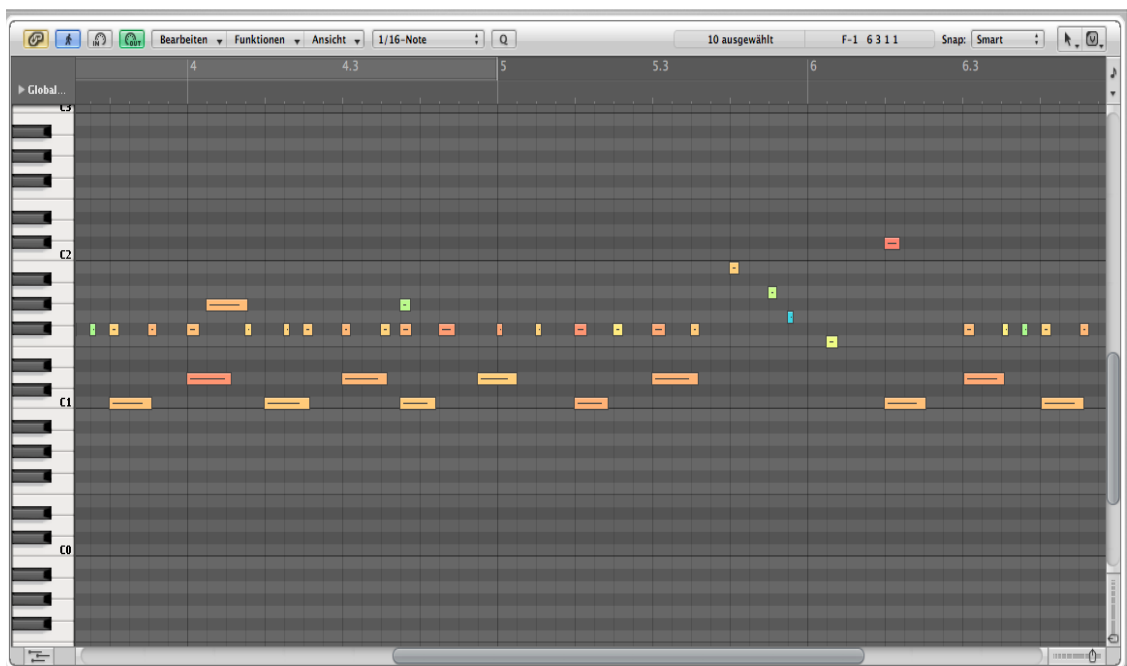

Fig. 7: Piano Roll - Logic 9.1[41]

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41 source: personal screenshot
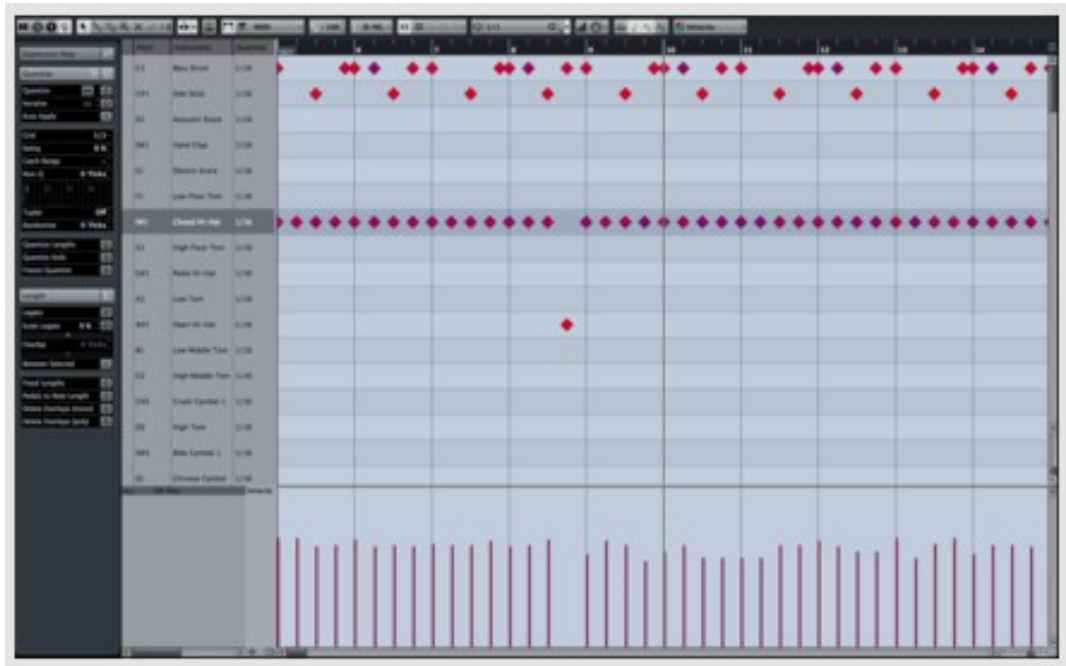
Fig. 8: Drum Editor - Cubase Pro 8[42]

- with a MIDI keyboard (on each key there is a different drum or cymbal or another articulation).

- with an electronic drum-set (see Fig. 9). This is similar to a drum kit set up and has pads (small rubber or drum skin-like playing surfaces), which transform the strokes into MIDI signals. Thus, someone can play drums like on an acoustic drum-set, but trigger the sounds of the sample library, i.e. it sound like the drums of the sample library.

42 source: http://www.steinberg.net/en/products/cubase/what_you_get.html, retrieved 1.10.2015

Fig. 9: Electronic Drum-Set[43]

- with MIDI pads (MIDI controllers). These are small, velocity-sensitive rubber surface pads which can be played with the fingers. They are often arranged on the keyboard but are also available as a separate unit (e.g. the Nanopad 2 Korg, see Fig.10). This feels more like drumming than hitting keys on the keyboard, since the surface is not moving. It also makes it possible to play more quickly as the keyboard keys have to move a specific distance until they can be struck again. Especially when playing a roll (= quick succession of strokes alternating with both hands) the keyboard keys react too slowly.

Fig. 10: MIDI-Controller Korg Nanopad 2[44]

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43 Roland TD-30K V-Pro Serie, https://www.rolandmusik.de/products/td-30k/, retrieved 1.10.2015

44 http://www.korg.de/produkte/pc-tools/nanopad2-produktinfo3/nanopad2-produktinfo-2.html, retrieved 1.10.2015

3.6 Sample Libraries for Drums

There are many sample libraries for drum-sets on the market. All the major manufacturers such as East West, Vienna Symphonic Library, 8DIO, Native Instruments, Spectrasonics, etc. have a variety of libraries. There are also a number of smaller providers, who mainly offer audio loops.

A distinction has to be made amongst the sample libraries that deliver drum-set sounds for example the "Abbey Road drums" series[45] (see Fig. 11) from the MIDI-loop-plugin Stylus RMX by Spectrasonics[46] (see Fig.12). A sample library that provides drum-set sounds, sounds very authentic like a specific drum-set. When the programming is good one has the impression as if they are listening to a live drummer. In addition, some programmed MIDI loops are included in the library.

Fig. 11: Abbey Road 60's Drummer[47]

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45 cf. http://www.native-instruments.com, retrieved 1.15.2015, In this series drums from different decades are sampled. So there are two drums sets from the 1950s, 60s, 70s and 80s and two Modern sets. So that typical for the genre sounding drum-sets are available, in order to, for example, produce music that sounds like James Brown.

46 https://www.spectrasonics.net/products/stylusrmx-audio.php, retrieved 1.10.2015

47 http://www.native-instruments.com/de/products/komplete/drums/abbey-road-60s-drummer, retrieved 1.10.2015

The Stylus RMX has a different concept. Various MIDI loops can be chosen from a variety of genres and can be changed quite simply and quickly into a wide range. Results are achieved quite quickly that satisfy (and stimulates your own creativity) without even playing the drum track by hand. The sound is more modern, sounds rather artificial, but also very good. Thanks to its simple operating concept with respect to the variability of the loops, this is a hybrid product between audio loops and MIDI sample programming.
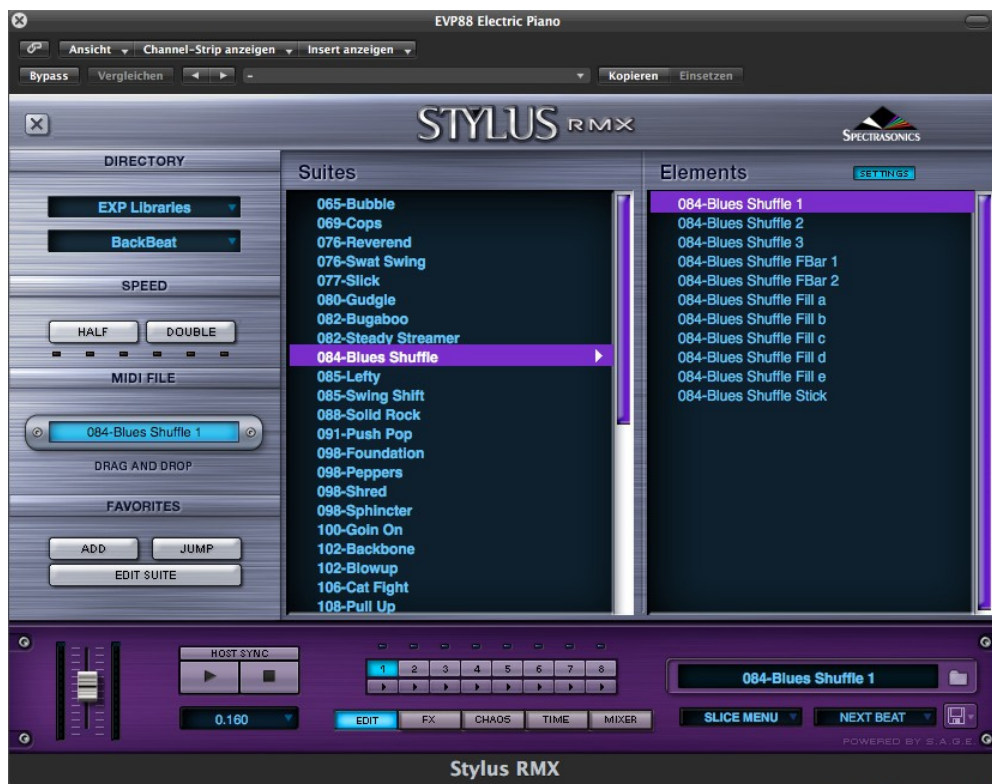
Fig. 12: Stylus RMX from the company Spectrasonics[48]

There are also a variety of drum-libraries serving the genre "Epic film music". In action movies and trailers, a certain high energetic sound with lots of sub-bass frequencies has been established. "Zeus" of 8DIO or "Storm Drum" from East West should be mentioned here. These libraries have processed their sounds so

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48 source: personal screenshot, Stylus RMX from Spectrasonics,
    https://www.spectrasonics.net/products/stylusrmx-audio.php, retrieved 1.10.2015

that they do not sound like a real drum-set, but rather percussive, epic and with lots of bass.

Appendix 9.4 shows a compilation of high-quality drum sample libraries that are currently available on the market.

4. Remote Recording of Drums

Remote Recording refers to a service offered by musicians – individually or as a group – to play compositions from clients who can live thousands of kilometres away at an affordable price in their home studio[49].

In this definition from Stephan Eike, one has to look further into the phrase "home" with regards to drum-sets. In comparison to recordings made with a violin, vocals or guitar for example, the recording of a drum-set requires a large room that is soundproof. In an urban area this is a scarce commodity. Many drummers manage by sharing a rehearsal room with other musicians or renting a studio for recordings.

4.1 Process and Functionality

If a composer for various reasons decided to use a live drum-set in his composition, previously he only had the possibility to book a large studio and hire a drummer if he did not have his own large, good sounding and soundproofed studio. In recent years, a new option has been added, the so-called Remote Recording. This works as follows: The composer sends his more or less completed produced music via internet to a drummer. The drummer uploads this music track in his recording software and records the desired drum accompaniment in his own studio. The musician then sends the recorded tracks to the composer who then inserts it into his project. Sometimes the raw individual tracks are the goal, another time the drummer sends an already mixed and sound edited stereo mix that the composer can use directly in his project without any necessary editing[50].

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49 Eicke, 2014, p. 34, translated from German

50 cf. http://www.alexreeves.co.uk/, retrieved 1.23.2015 and http://www.boomcrashdrumtracks.com/, retrieved 1.23.2015

The advantages of organizing the studio session yourself rather than using Remote Recording are:

- The composer is present at the recording, and can intervene directly in the recording, can direct the drummer through signs (conducting) during the recording and can resolve on-location details with the drummer, state his wishes, respond quickly to takes[51] and influence the result in the direction he desires.
- Sometimes a time constraint is advantageous because you have to concentrate on the essentials and not get easily lost in details.

There are many disadvantages:

- A large budget is required. The costs for drummers, the studio and also the recording technician add up.
- Inflexible scheduling. The scheduling availability of the drummer has to be synchronized with the studio and the technician. Large studios often have a long waiting list until a slot is free.
- The drummer is working under time and perfection pressure, he has to deliver an outstanding drum track within a short space of time because the studio is only booked for a certain time. This can have a negative impact on his inspiration depending on the personal character of the drummer.
- In the equipment selection, the drummer's set-up is limited to what he has brought with him to the studio.
- Requests for changes after the session are hardly possible because the exact same configuration of recording space and drummer is no longer available.
- If the result is not satisfactory, the whole procedure must be repeated.

If the composer's studio is suitable for drum recording, then some of these disadvantages don't apply. Remote Recording has much more advantages and just a few disadvantages in comparison to the previous settings when the composer books a studio.

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51 A "take" is a instrumental recording, usually the drummer plays multiple takes, from which the best version is selected

<u>Advantages of Remote Recording compared to drum-set recording in a rented studio:</u>

- Lower costs, since the cost of studio and technicians are not necessary.
- The drummer has immediate access to all of his equipment and can relatively easily try different setups.
- The drummer is not under time pressure (except if the composer requests a short deadline for submission).
- The drummer does not have to carry around his equipment that can be used immediately upon request as the mikes are already positioned.
- Very fast delivery possible because only the drummer's schedule has to be considered.
- The composer's selection of drummers is not limited to the few that he knows personally or were recommended to him. Offers via Internet can be compared easily and an optimal for the composition suitable drummer can relatively easily be found with respect to his offer and skills.
- The drummer is working in a familiar environment and can, without stress, do as many takes as required until he is satisfied.
- For later modification requests, the same setup is available. As a result, small improvements can be made or entire takes repeated without the sound being different and thus no longer homogeneous to the other recordings.

The <u>disadvantages</u> for the composer are:

- It is easy to offer Remote Recording in internet, so there is a wide selection. From adolescents who have only been playing drums for a few years and record inferior drums in their room to professionals, experienced drummers with a highly professional studio and equipment, there is a wide range of offers. Whether the advertised quality will be delivered, is only learnt through trial and error. It is also sometimes difficult for a composer who is not familiar with the drum-set to separate the wheat from the chaff that is to determine which offer promises more quality.

- The composer may not have a direct impact on how the drummer plays. He can only judge the delivered recording and then based on this articulate changes. Often, the drummer has already done many takes because he wants to present the best possible result. So it's not so much a collaborative work, but a serial between composer and drummer. From this disadvantage a new software (Steinberg VST Connect) was created, more on this in Chapter 7.2

4.1.1 MIDI Remote Recording

Remote Recording represents a compromise variant, in which a drummer records MIDI tracks on an electronic drum-set. The composer can then use his own sample library, the tracks can easily be edited (quantized, velocity changed, strokes added or deleted ...) and assumes that the track was really recorded by a drummer and therefore probably sounds more real than when an unexperienced composer has programmed the track himself. However, an electronic drum-set does not (as yet) come anywhere close to an acoustic drum-set with respect to nuances and lively impression. This can clearly be heard with the cymbals. In addition the ambient sound of the studio is missing.

4.1.2 Hybrid-Production

Another version is a mixture of Drum Programming with additional Remote Recording. *"The vast majority of advertising music today is made with electronic sound generators. However, the sound experience has a more intense effect, because it is "more human" if performed live, and a non-sampled solo instrument (e.g. Saxophone) has the leading voice. The same applies to the strings: A sampled string section sounds absolutely 'real' when additionally only one violin plays live! (Trumpet section ditto!)* "[52]

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52 Wüsthoff, 1999, p. 39, translated from German

The sound quality of the drums are far less dependent on the style of play than the different stroke techniques of the drummer as the cymbals are. And therefore easier to reproduce with sample libraries without sounding unnatural or mechanical in the sequence. The composer can take advantage of this circumstance and program the bass drum and snare. The Remote Recording drummer then records only the sound-critical cymbals and hi-hat and gives the drum track a lively, authentic sound and a "real" feel. Also, specific genres such as electronic music need a certain sound from bass drum and snare, which can only be generated with a lot of sound engineering expertise from the recording of a real drum-set. Also, sometimes a strict quantisation is a stylistic feature that can easily be realized through Drum Programming, but with Remote Recording requires significant post-editing. In these cases, a hybrid production is a very good option.

4.2 Conditions

4.2.1 Parameters on the part of the Composer

4.2.1.1 The Playback

In most cases, the composer sends the drummer a more or less finished produced playback. It is also conceivable that the composer wants to be inspired by the drummer and only suggests, for example, style and tempo. The drummer can play freely, try a few groove variants and add a few fill-ins. From the recordings, the composer can then edit it all together and composes the rest of the instruments. This would be the same approach as in audio loop-based composing.

However, through feedback to the drummer it is also additionally possible to later incorporate requests. The "Audio Loop" that the drummer recorded in his studio can be adapted in all directions of the relative style, sound (e.g. Hi-hat instead of cymbals…), intensity, frequency and much more.

If the composer sends a finished playback, this can be with or without a drum track. If a drum track is already defined, it has the advantage that the drummer better knows what the composer wants. He can either play the same - with "human feel" - or try building his own ideas based on what was given.

This possibility to get the drummer's idea is of course greater when no drum track is given. This can have a positive effect. It is possible that the drummer delivers something that the composer would not have thought of and this enriches the composition.

But it can also mean that the first attempt goes in a completely different direction, as the composer intended. It may then need frequent takes and a lot of feedback until a satisfactory result is achieved.

4.2.1.2 The Click-Track

"A click-track (often abbreviated to Click) is a computer-generated or a metronome generated ticking which specifies the beat and the exact tempo progression of a music piece. *For live productions, the musicians and - if available - the conductor listen during the recording with headphones to the click in order to prevent tempo changes and to ensure the synchronization of music with the picture.*[53]" Each piece of music to be recorded, receives a click-track.

Attention should be paid to ensure that there is not too much unpredictable tempo fluctuations in the click-track. In most cases, the result of the drum-set recording through Remote Recording is of higher quality when the composition has a constant tempo. To record an entire band, it is not necessary (and sometimes even a hindrance) during the recording to fix the tempo with a click-track. Tempo fluctuations are organic and arise from the overall structure of the band, every one reacts with and in succession. For the listener, tempo fluctuations are not very noticeable or even have a positive effect when they are carried out by the entire

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53 Weidinger, 2011, p. 98, translated from German

band. *"Minimum rate fluctuations that you feel more than hear give a piece of music more life and allow a natural, non-mechanical sounding interpretation."[54]*

For a subsequent drum-set recording for music that has been produced without click with tempo changes, it is difficult for the drummer to follow the tempo fluctuations of the other musicians. He will be, instead of a part of the same, with his tempo changes always the follower. He can only react and adapt. This leads to a rather strong concentration of the tempo, more cautious, inhibited playing of the drum-set. For the listener, this can be recognized by the fact that the entire composition doesn't have any power. It is much better when the drummer has a steady click-track that he can adapt the volume independent of the music according to his preferences. That doesn't mean that the composition must always have one and the same tempo. Of course, individual sections may have different tempos or be continuously slower or faster (ritardando, accelerando).

In practice this means for the composer that he, for example, as film composer cannot (without tempo) freely compose for the picture, if he wants to later record a rhythm oriented drum-set. He has to decide on a specific tempo value before composing and then import the various instruments suitable for the click-track. This tempo can of course be changed. Since the music has a constant tempo, this is not a barrier to a high quality result. In many cases, the tempo is already the starting point for the compositional consideration. If the composer selects the tempo as the starting point, he will then try to find the perfect basic tempo for the important scenes independent of the harmony or melody. He pays attention to how a specific tempo behaves with the dialogue, whether important synchronization points are supported and how the emotional rhythm of the scene develops. If, for example, in a car chase scene certain synchronization points should be musically reflected, it is only successful if the music has the optimal speed. Therefore, the tempo for action movies is often the starting point of all compositional considerations.[55]

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54 Weidinger, 2011, p. 98, translated from German

55 cf. Weidinger, 2011, p. 83

4.2.2 Parameters set by the Drummer

The quality of the remote-recording drummer's drum-recording depends not only on the musical skills of the drummer but also which drum-set with which recording equipment in what way and in which studio the recording was made.

4.2.2.1 Drum Equipment

As already explained[56], the drums should sound different for different genres to appear authentic, and to be able to fit harmoniously into the overall sound of the composition. A drummer who has several drums to choose from, can record different styles melodiously true to its style. However, every drummer, due to personal musical preferences and technical playing skills, does not play all styles equally well. Many drummers therefore specialize in the course of their career in a particular genre. A Rock drummer plays and sounds very different than a Jazz drummer to name just two genres as an example. Therefore, a good drummer with only one setup in a certain genre can make an excellent recording. The drummer should therefore, if he offers Remote Recording, also define and limit his styles. If a drummer offers for example "all styles" he should also have appropriate setups available if he is striving for high quality. From my experience as a drummer in the genres of Jazz, Funk, Pop, World, it is necessary to have multiple setups. It is of course a matter of taste, what instruments you have available.[57]

4.2.2.2 Recording Equipment and Recording Competence

Of course, the recording equipment and how the drummer applies it greatly influences the quality of the recording. The signal chain includes the microphone components, preamps and A/D converter (= analogue to digital converter). The nature of the DAW software used plays a minor role, since the standard

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56 see chapter 2.3 Setup for Various Genres

57 see Appendix 9.5 Equipment List Remote Recording

professional programs such as Logic, Cuebase, Pro Tools, to name a few, all have a high quality level, and in relation to other components of the signal chain cause only negligible changes in sound.[58]

The minimum microphone setup is two overhead microphones and a bass drum microphone (for stereo recording). Default is two overheads, a bass drum microphone, snare batter head, snare resonant head, one microphone per tom tom, a stereo room microphone (or 2 x mono mic) and a hi-hat microphone.[59] In a drum-set with 3 tom toms, this results in eleven audio tracks.

In order to have even more options when mixing, a second bass drum microphone can be placed before the resonant head in front of the bass drum, and with another microphone the sound of the drum shell from the bass drum and/or snare can be recorded. For the bass drum, there is also the option to record the sub-bass frequency with a special microphone (e.g. the "Sub kick" Yamaha).

Of course, more microphones can be used, for example, additional room microphones at different positions in the studio. In order that this extra effort is worthwhile, a good sound engineer is needed for the mix. The more microphones available, the higher the number of phase problems. And each microphone must be adjusted and equalized so that the remixed sound is not unclear and washed-out.

If the composer wishes to have a final mix and not only the raw .wav files of the individual microphone signals, the quality of the effect plug-ins also has a large impact. Most frequently used are equalizer, noise gate, compressor and reverb. There are also specially designed effects for drum-set mixing that combine a

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58 cf. Klebs, 2011 p. 83: Professionelle Musikproduktion vs. Freeware Homerecording, The author confirmed with a test set his thesis: "Using the Internet freely accessible, free software for production steps recording and mixdown, it is possible to create a music production, which from a group of experienced and inexperienced listeners cannot be distinguished from a professional studio production."

59 see Appendix 9.5 Remote Recording Equipment List as an example of conventional drum-set microphone set up.

package of different effects in a single plug-in, for example, the Chris Lord-Alge Signature Series from the company Waves[60].

And last but not least, the skills of the drummer as a sound engineer are of great importance. How he positions each microphone has an enormous effect on the recorded sound. When the drummer works with a good and experienced sound engineer, it is of course an advantage. However, this increases the cost of the Remote Recording session as an additional person has to be paid. A compromise for the Remote Recording studio owner is to have an experienced sound technician position the microphones and provide practical tips for different set ups of his recording equipment. Subsequently, the drummer can then set them up exactly as suggested, thereby achieving a good sound and a professional sounding starting point with which he can experiment with.

4.2.2.3 The Studio

The sound of a drum-set is very much defined by the room in which it is recorded. The sound of the studio is therefore a very important quality criterion. This differentiates the providers of Remote Recording and separates the wheat from the chaff. When someone records in an acoustically untreated basement, the sound of the drum-set cannot develop. However, it can of course be that the generated sound in this setting is exactly what the composer requires. But in post-production, you will be faced with more limits as with an optimal recorded drum-set as these are difficult to avoid through the room geometry and reflection interference, and standing waves. Standing waves are created when a sound wave is reflected between two walls so that the same waveform patterns overlap each other in the room. If the wavelength of the vibration is in a favourable relationship to the distance of the reflection surface, the sound wave will create maximal sound pressure (high pressure change) at specific points in the room. At

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60 see http://www.waves.com/bundles/chris-lord-alge-signature-series, retrieved 2.25.2015

other points in the room, however, there is a cancellation of sound (no pressure change).[61]

To achieve a high quality recording, the room should be acoustically optimized and its size should be at least 12-15 m². A musician would say the drum-set needs room to breathe, to develop its sound, an acoustic engineer would argue with the ratio of direct sound and reverberation, reflections, interference, the comb filter effect, frequency-dependent absorption characteristics and the like[62]. Acoustically optimized, in this context, means that the room sounds largely linear, with no occurrence of strong standing waves and sound valleys or even flutter echoes[63]. This is more or less intricately achieved through acoustic elements (absorber and diffuser). Since this needs much expertise[64] and is also priced accordingly, a good room sound is a sign of good quality with which various Remote Recording providers can be classified.

However, a good sounding room does not have to meet the high demands of an acoustically perfect optimized recording studio. As a Remote Recording provider, it is not necessary to do complex acoustic measurement. A clapping test can already provide some insights on the room acoustics. Clapping can be used to determine how long the sound needs to fade away and whether flutter echoes can be heard. If certain frequencies dominate this is an indication of distinct standing waves.[65]

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61 cf. Friesecke, 2009, p. 51f

62 cf. Friesecke, 2009, p. 32ff

63 cf. Görne and Bergweiler, 2004 p. 119: Flutter echoes are reflections that swing between two reflective parallel walls. They have a bright, metallic sound. In general, flutter echoes occur at high frequencies.

64 cf. Friesecke. 2009. The author describes the acoustic principles that need to be considered, if one would like to have an acoustically optimized room. He gives formulas based on which you can set specific measurements to optimize the acoustics. This is done with wall linings, room in room design, convoluted foam absorbers, Helmholtz resonators, diffusers, etc.

65 cf. Heer, 2011, p. 7

4.2.2.4 Knowledge of Musical Genre

If a composer has several drummers for the same composition and he doesn't advise what has to be played, often he will get different results. Independent of the quality of the musical performance[66], every drummer will play differently depending on his preferred stylistics. Each musician is familiar with certain genres and therefore, can only reproduce certain genres. The wider the musical experience of the drummer within various genres, the more likely that the way he plays will meet the expectations of the composer, provided he has not already chosen a particular drummer based on his personal style.

Often the composer has more or less clear expectations of how the recording should sound or rather what the drummer should play. If the drummer has a lot of experience in a particular genre then he will exceed the expectations of the composer. In the reverse case, it may easily happen that the composer cannot exactly say what it is but feels that something in the drum tracks does not match the composition. If the composer has an exact idea, he can help the drummer to have a satisfactory result, but it often requires multiple takes and frequent feedback. It also depends on selecting the right equipment[67] as well as what (which notes) and especially how (which feeling) it has to be played. Also in the case that the composer has only vague ideas of what he wants to hear from the drummer, then a genre experienced drummer will be able to quickly please and produce a satisfactory recording for the composer.

4.2.2.5 Musical Performance Quality

A very important part of Remote Recording is the drummer's playing quality. That depends on one hand on what he plays[68] and just as important, on the other hand how he plays. This quality cannot easily be detected by untrained listeners.

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66 see Chapter 4.2.2.5 Musical Performance Quality

67 see Chapter 4.2.2.1 Drum Equipment

68 see Chapter 4.2.2.4 Knowledge of Musical Genres

Sometimes strengths and weaknesses are only clear with a direct sound comparison with another drummer. In order to evaluate and assess the quality of the musical performance, the following questions can be asked:

- Does it have the right feeling?
- Is the rhythm played hard/soft enough? With the right emotion?
- How is the micro timing? Is the rhythm "shaking"? Is the groove always stable on, before or after the beat?
- How good is the timing, the tempo constant? Is the drummer faster or slower at certain moments?
- How good is the volume dynamic? Are some drums too loud, too quiet, and not hit well?

Of course, the assessment of the quality of musical performance has a strong subjective character. Especially with good drummers, it is often a matter of taste, which is preferred. Where one has more drive, another is more playful, a third plays very powerful, a fourth extremely accurately, etc.

In contrast, poor drummers receive objectively understandably criteria, such as bad timing or shaky Micro-timing so much that one does not have a chance to apply taste criteria.

5. Definition of Decision Parameters

If a composer is undecided as to whether he should program the drum tracks himself or use Remote Recording, there are a lot of parameters that need to be considered. Since there is little literature about this matter, a SWOT analysis is a helpful tool in order to depict the field of Remote Recording and Drum Programming analytically and not overlook any important details of the decision.

The SWOT analysis method comes from the field of strategic management and is usually used to develop strategies to position a company or product on the market[69]. SWOT stands for **S**trengths **W**eaknesses **O**pportunities **T**hreats. The major strength of the SWOT analysis is that an analysis from the internal perspective as well as from the external perspective is performed. The internal view evaluates the strengths and weaknesses of the product, company or an idea. The external view defines the chances and risks from the market, the outside world or the consumer. This method is also suitable to deal in detail with ideas and to evaluate them as it provides a dual view of the idea (an internal and external).[70] In order to apply the SWOT analysis to the issues discussed in this thesis the classic question needs to be adapted. The aim of this master thesis is to compare Remote Recording with Drum Programming, to determine their advantages and disadvantages and to define the decision making parameters from the composer's point of view, whether in a particular case the composer's programming or Remote Recording is the better choice. It is about analysing the strengths and weaknesses of Remote Recording and Drum Programming with consideration of the composer's working environment and typical work day. The adapted question of the aim of this master thesis is as follows:

- Internal analysis: What are the strengths and weaknesses of Remote Recording and Drum Programming?
- External analysis: Which factors in the composer's working life affect Remote Recording and Drum Programming with respect to a decision being positive or

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69 cf. Kotler, Berger, Rickhoff, 2010, p. 30

70 https://www.designthinking-wien.at/blog/2014/12/technik-swot-analyse, retrieved 1.23.2015

negative? The analysis of Remote Recording and Drum Recording from the perspective of the composer corresponds to the opportunities and risks of classical analysis model designations.

Two SWOT analyses have been carried out – one for Remote Recording and one for Drum Programming.

		Strengths	Weaknesses
		- High quality - Time required - Matches genre	- Expensive - Depends on genre - Time required for feedback - Depends on provider's quality
Opportunities	- Time pressure - High quality required - Increasing awareness of Remote Recording - Increasing offer	*(Quality)*	
Threats	- Low Budget - A clear conception from the composer - No or bad experience with Remote Recording - Quality is not achieved		*Budget*

Table 1: SWOT-Analysis Remote Recording[71]

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71 source: personal analysis, also see http://www.alexreeves.co.uk/, retrieved 1.23.2015 und http://www.boomcrashdrumtracks.com/, retrieved 1.23.2015

		Strengths	Weaknesses
		- Cheap - Fast - High quality in certain genre	- Quality - For high quality high time requirement - Genre
Opportunities	- Time pressure - Good Sample Library - Genre - Low Budget - No Studio Equipment	*Budget*	
Threats	- Time pressure - Precise ideas - Genre		

Tabel 2: SWOT-Analysis Drum Programming[72]

Based on the SWOT analysis it can be seen that no general, situation-independent statements can be made. Most parameters can impact both positively and negatively and also depend on each other.

On the premise that a very good Remote Recording drummer is available, and there is no time pressure, you might superficially recognize a trend: Remote Recording strengths lie in the quality, the weakness in the cost. However, this is a highly simplified representation, for a more detailed analysis, the individual parameters must be looked at in more depth. The comparison of the two SWOT analyses shows that the following variables are relevant for a decision:

- Budget: How much money does the composer have for the production of the drum track?

- Time: Is the composer working under time pressure or does he have enough time to program details or to execute more feedback loops with Remote Recording?

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72 source: personal analysis, see also http://www.siliconbeats.com/program-drums, retrieved 1.29.2015

- <u>Genre:</u> How familiar is the composer with the style of music with regards to drums?

- <u>Achievable quality:</u> This variable applies to both self-programming by the composer as well as the quality of the Remote Recording provider.

Then there are the parameters that fundamentally influence the decision, that is, which do not depend on the particular job. These are the personal components of the composer (his attitude and beliefs about Remote Recording and Drum Programming), room conditions and which experience the composer has already made with Remote Recording.

5.1 Basic Parameter Independent of the Particular Job

5.1.1 Personal Aspects

The composer's personal aspects includes his attitude to programming, how well does he like programming drums. It depends on what programming represents for the composer per se, is it part of the artistic creation, an incentive and he enjoys doing it, and perhaps another composer is reluctant to do it and delegates the Drum Programming to someone else. Programming often means hours of solitary work on the computer, while Remote Recording often means less work and also contact and communication with others (at least with one person). People are different, therefore one or the other setting is more appealing to the respective composer.

Also certain inner convictions already exists prior to the decision to program for yourself or to hire a drummer. The composer Niki Reiser, for example, produces his film scores mainly with real musicians, he hardly ever uses electronic sound generators. "*One reason is that I do not have a skilled command of electronic sound generators and therefore want to avoid them. The second and more important reason for me is that with real musicians, there is an added dimension to the music. You have, for example with a real orchestra fifty people who are*

producing - with different tones. And I find that music as a three-dimensional element is also very becoming, when not only one person uses the tone controls but several people are involved in the interpretation."[73]

This factor - the inner attitude and inner conviction - is not insignificant but it influences the decision that our topic is based on. People orientate themselves rationally but often make decisions emotionally. This thesis deals only with the rational level of the pro and contra of the decision Drum Programming versus Remote Recording. For the actual decision the personal component also has a role, therefore, this aspect is mentioned here.

5.1.2 Spatial Conditions

This parameter has two components. On one hand, the composer's available room situation is relevant. Does he have a studio that is big enough, soundproofed and sounds good, then he may consider the possibility to record the drum-set himself. This is, however, rarely the case. Only a few composers have a perfectly acoustically treated music studio. Most composers have simply converted one room in their apartment to a film music studio.[74] This first component is not part of the analysis, since it involves outsourcing the drum recording with Remote Recording.

The parameter that is important for the analysis is the room situation of the drummer being recorded. Points that are relevant are:
- <u>The studio's sound</u>
Depending on room size and any acoustic optimization you will get different results. The main questions are: How dry (= short reverberation time) does the room sound, what is the frequency spectrum like, are there standing waves?

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73 cf. Weidinger 2011, p. 63f.

74 cf. Kümpel, 2008, p. 38

- <u>Temporary availability</u>:

Is it the drummer's studio or is it rented and must adhere to a schedule. In the latter case, Remote Recording is not immediately available, even if the drummer has time. The production time is thus increased, i.e. the time until the drummer delivers the recording. But this point has no effect on the time requirements of the composer.

- <u>Flexibility in recording mode</u>:

It has to be noted, if the drum-set is permanently positioned and microphoned or does everything have to be assembled and disassembled. This point is important if later (on the next day, or a month after the recording) requests for changes are made. This affects the budget and also whether the same sound will be achieved.

5.1.3 Contacts and Experiences with Remote Recording

Contact to top professional musicians belong to the resources of a film music composer. The opportunities to commit musicians for recordings are diverse. They range from students to internationally established studio musicians or orchestras. The costs vary accordingly from expense allowances starting at the level of unskilled workers to hourly fees at the level of top lawyers. The art of the composer is to know and select those musicians for each project that promise the best cost-benefit-ratio.[75]

Remote Recording is becoming more popular, it is a global market thanks to the internet. Theoretically, it does not make a difference if the composer and the drummer live far apart or close to each other. In practice, however, there may be differences and difficulties, if the two do not belong to the same culture. This is relevant to the costs, this also depends on the level of wages in the country concerned. Then there are cultural differences in the working habits and the usual quality standards.

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75 cf. Weidinger, 2011, p. 115

The following aspect is also important and this can be a very desirable effect: People are musically formed by their mother country. The musical language with her nuances can be compared to spoken language. A Spaniard speaks English differently to a German, an English person or American, the accent is different. Just as there are differences when an Indian, Chinese or European drummer plays the same notes. The difference lies in the feeling and can be determined in the accentuation and phrasing, in the micro-timing. The idea here is generally formulated and loses with respect to people's individual differences its generalizability. Thus, it may happen that a European drummer that listens to and plays, for example, a lot of funk music, does this more authentically than an American drummer who grew up with this music, but has had little dealings with it.

The parameter that is being discussed in this chapter is how much experience the composer has already made with Remote Recording. Has he already had a good experience with Remote Recording? Or did he have a bad one and was not satisfied with the result? Or is this a complete new area for him? If a composer has had a positive experience with Remote Recording or at least he has found a drummer with whom he can work well, this makes the decision easier to use Remote Recording. If a composer has to first find a suitable drummer that offers Remote Recording and he doesn't have any experience with the Remote Recording process, this creates considerable inhibitions. A risk, as ultimately money is being invested, which in retrospect becomes clear if the result is useful. To reduce this inhibition as much as possible, free sample recordings are offered by some drummers. Agency portals such as Session Exchange[76] try to decrease the threshold by defining quality criteria that musicians must achieve to be included in their offer and on the other hand, clients have the opportunity to write assessments that serve as a guide for other potential clients. At Session Exchange applying musicians are asked to prove their experience as a session musician and to submit video and audio recordings of their music, which are subsequently evaluated by the operators of the platform. This ensures that the

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76 "Session Exchange is a directory of online session musicians and music services professionals who can offer their services without the costly hire of a commercial recording studio. Each musician has their own recording set-up, professional performance and recording experience, and clients who can vouch for their services. Our listed members have worked with major labels, world class orchestras, and on award-winning projects", http://sessionexchange.org, retrieved 7.1.2015

composers who hire a Session Exchange artist, obtain a result, which can be measured by professional standards.[77]

The composer's lack of experience with regard to the hiring of Remote Recording will also have an effect on the time budget. Processes have to be learnt and from existing contacts, recommendations from colleagues or the Internet a suitable drummer has to be found, who also offers Remote Recording. Important points to be considered are:

- <u>The Communication:</u>
Is it easy to access the drummer? Are there any difficulties in understanding the linguistic form? How empathetic is he, how well does he understand what the composer wants to hear, how the composer wants the drum track?

- <u>Professionalism:</u>
How quickly does the drummer deliver his recording, how quickly does he responds to feedback and change requests? Does he keep agreed upon deadlines?

- <u>Quality:</u>
What is the quality of the delivered recording, both the audio technology (recording format), the sound as well as the content (what and how it is played? Is a lot of reworking required in timing, in the dynamics ...)?

The audio technology aspect is mainly about the recording format, 16 bit or 24 bit resolution at 44 kHz, 48 kHz or 96 kHz sampling frequency. Larger values result in higher quality sound results. This aspect does not have a strong effect. In practice, only persons with a trained ear can distinguish between 16 bit/44kHz and 24 bit/96kHz. How much of the difference is audible, the opinions of the experts differ extremely.[78]

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77 cf. Eike, 2015, p. 34

78 cf. Katz, 2010, p. 311

The tonal component includes the questions how and which types of microphones are positioned (this is a question of the sound engineering skills of the drummer), in which room does the recording take place, this means how good is the sound in the studio, and of course, how good does the drum-set sound acoustically (how high is the quality of the drum-set and how well is it tuned).

5.2 Situational Parameters

5.2.1 Financial Budget

The financial budget that is available to the composer for the music, partly determines the work process. Earlier, it was often the case that the film music budget for example was divided as a royalty for the composer, a royalty for the arranger or orchestrator, a budget for recording and a budget for the final mix. Today, it is common, especially, with small productions that the composer is paid for his finished produced music. This is called Package Deal, which is common in Germany especially in television as well as on low budget film productions. The composer agrees to a fixed sum with the client and delivers the finished music at the arranged time, the so-called master tape in the film mix. All costs associated with production of the film music is borne by the composer.[79]

This is also true for television shows in America. *„In 2002, though, there were very few shows with orchestras of any size. Most shows will be self-performed by the composer with perhaps an occasional live musician or two. These shows are almost always package deals in which the composer is responsible for all music production costs (with certain exceptions) required for delivering the finished score. On package deals, every budget decision has a direct impact on the composer's income, because he only earns the amount left after all expenses have been paid out of the negotiated fee.“*[80] That also means that it is largely left to

79 cf. Weidinger, 2011, p. 130

80 Karlin, 2004, p. 51, translated from German

the composer as to how the available production budget, within certain guidelines, can be divided amongst the various production steps. If he uses less budget for the production, then he receives a higher royalty.

It depends on where the strengths and weaknesses of the composer lie. If he is, for example, a terrible sound engineer, he will outsource the final mix to a good sound engineer and have to reserve part of the budget for it. Or maybe he needs to consult an orchestrator because his own knowledge is not sufficient in this field. Therefore, the question of whether he programs the drum-set himself and use Remote Recording, is a question of his own budget. If he outsources Remote Recording, he gains time and increases the quality of the music, but in the end earns less.

The budget is therefore usually not a fixed amount but is subject to the discretion of the composer, how much is it worth to him to hear live drums in his recording. How much money is really available, depends, of course, on the total budget, which is available to the composer.

One can make the basic assumption that the higher the Remote Recording budget the better its quality. Remote Recording with an experienced, reputable top drummer who records in a good studio with excellent equipment and perhaps even with a sound engineer, who does the microphone setup and the mixing, costs more than a semi-professional drummer who records at home with cheap equipment. However, it may well be that an even better result is achieved by the poorly described option, as if the composer programmed himself.

5.2.2 Time Budget

Composers today are often working under time pressure. For Film Music, the composer only has a few weeks between the time at which he receives the finished edited film and the final mix. For television, several series have to be produced per week. Even in the advertising industry, the deadlines are very tight.

The time required to complete the music is often a significant size and an important factor.

If a composer is unable to meet the deadline then he risks losing further jobs. Therefore it is important that all involved parties to whom he outsources reliably meet their deadlines. Conversely, this means that time pressure may increase the inhibition to book Remote Recording because it represents a risk that you are dependent on the reliability of the drummer.

If there are strong time constraints and the composer decides to use Remote Recording, he would prefer a drummer that is immediately available and can quickly deliver a good result. If more time is available, then the achievable quality is more important, the composer can then give feedback, request more takes or call for changes.

If the composer decides to program the drum-set himself, this in turn depends on the genre as to how much time is required. If only one or two loops is needed for the entire piece of music as is common for example in the genre of House music, the composer does not require much time. In most cases, this is faster than organising Remote Recording. If for example, a complicated piece for a jazz drum-set needs to be programmed as authentic as possible, it may take some time to make the variations and fills realistic. In most cases, this can be accomplished more quickly with Remote Recording.

In any event, the variable time has two meanings. On the one hand, it's about the time required for programming, or for booking Remote Recording. This is actual working time, in which the composer is unable to do anything else. This must be differentiated from the production time. This is the time that it takes until the final outcome is achieved. The advantage with Remote Recording is that the time, while he is waiting on the results from the drummer, can be used for other activities.

5.2.3 Musical Genre

Many different styles of music exist. Every culture has its own stylistics and very many subgroups. Only considering European music with its history from the beginning to classic to modern has many different influences and styles. Or Pop music that sounds different in France than it does in Israel. The more global the world becomes, the more mutual influences the styles have on each other, musicians mix the styles and this produces something new. The music industry also thrives on the fact that something new is always being produced. In recent decades, new styles have been formed through digitalising, like Drum & Bass techno. The film music has emancipated itself as a distinct genre and developed. One thinks of the many similar sounding action films trailer or an epic soundtrack.

If the composer would like to compose a Pop music piece that is for example oriented to The Beatles, a very different drum part is necessary as music in the genre "House". That means for the drum part, there is a large variety of basic rhythms with the corresponding feeling, sound and appropriate style variations and fills.

The variable "Genre" must be considered in two ways:

- <u>Effect of skills on the quality of the results</u>
The more stylistically diverse a composer composes (or must compose as per the contract), the harder it is to know the details concerning programming a drum part and to use them properly. Of course, it is not always necessary to work true to the original style, and also in the level of detail, there is much room for manoeuvre. However, some basic rules and subtleties must be observed for a credible overall composition in a particular genre. Remote Recording usually has an advantage over programming by the composer because the drummer is an expert in this area.

If the composer has a defined and detailed sound and rhythm concept in his mind and he wants to have it interpreted in this exact manner, he can tinker with the programming until the drum track meets his expectations.

This circumstance supports programming by the composer, since a hired drummer, despite excellent communication with the composer, may not interpret the idea in the same way. Also, individual notes cannot afterwards be simply adjusted as in programming. Then again, on the other hand, a second person can provide new ideas, which may provide an advantage for the quality of the overall results.

- <u>Effect of sound or playability on the quality of the result</u>
The newer styles such as Drum & Bass or Techno are particularly difficult to impossible for a drummer to play, since they must be implemented at a quick tempo with absolute precision, as only a computer can. Or drums in an epic soundtrack with the deep bass drums and many simultaneously played snares and cymbal rolls can be programmed with the help of typical genre samples and will better fit the genre compared to if a drummer tried to record that in his studio. On the other hand, wherever a natural sounding instrument is desired, Remote Recording is a promising method.

5.2.4 Achievable Quality

The achievable quality, whether it is programming by the composer or Remote Recording, depends on several factors.

Achievable quality programming depends firstly on the knowledge of the style details of the genre i.e. detailed deep knowledge of the desired result and on the other hand, on the sound quality of the sample library and the programming skills of the composer. (see Diagram 1). A sample library that does not sound so good, can be improved by editing with effects like equalizer, compressor, transient plugin ADSR control and others.

Genre

Quality

Sound quality of the library and
programming capability of the
composer
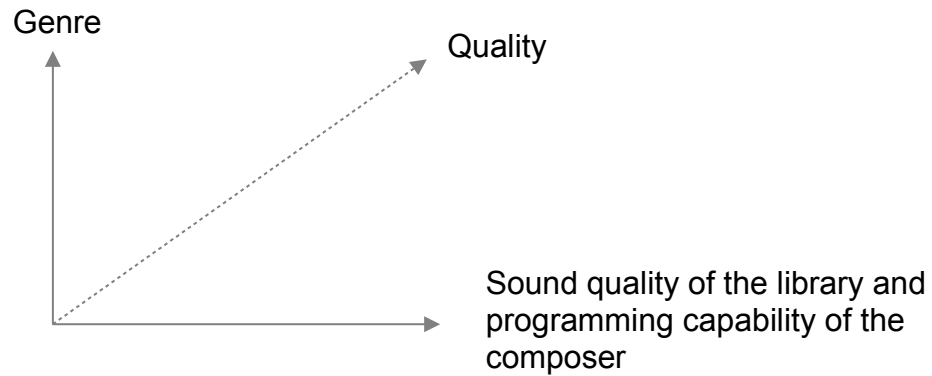
Diagram 1: (two-dimensional graph):
Dependence of the achievable programming quality on
genre competence and programming capability of the composer[81]

The technical level of the drummer on the instrument and his musicality (= genre
knowledge) defines the achievable quality in Remote Recording, on the one hand
and the sound of the instrument in the studio, on the other hand (Diagram 2 shows
this relationship).

Musicality and technical skills

Quality

Sound quality of the drums
and the studio
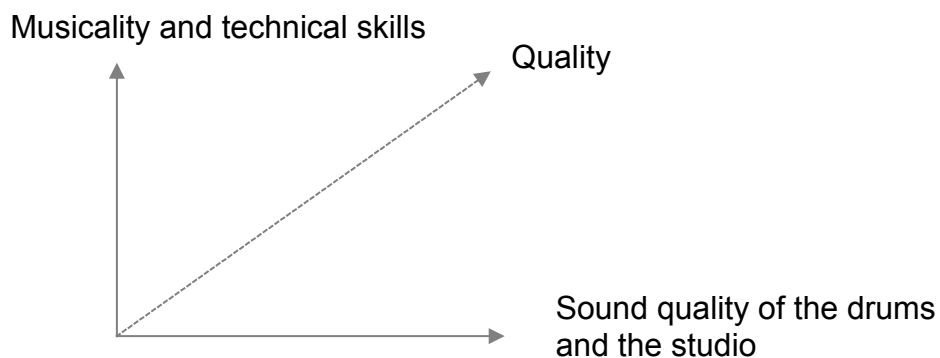
Diagram 2: (two-dimensional graph):
Dependence of the achievable quality of Remote Recording
on the musicality of the drummer and the sound of his instrument[82]

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81 source: personal analysis

82 source: personal analysis

Simply said, the achievable quality in both cases (Drum Programming and Remote Recording) depends on the musical competence of the person and the achievable sound quality.

6. Analysis of the Interdependence of the Parameters

As already made evident by means of the SWOT analysis and indicated repeatedly in the previous chapters, the decision for Drum Programming or Remote Recording is dependent on several variables, which interact with each other. And even within the programming and Remote Recording the variables are interdependent.

6.1 Interdependence of the Parameters in Programming

If the composer decided to program the drums himself, his available <u>time budget</u> influences the achievable quality as more or less time for the detail-programming is available. The <u>financial budget</u> also influences the sound quality. If an optimal sounding sample library is not available, one can be bought with the appropriate financial budget. And the <u>genre</u> influences the achievable quality depending on the competence of the composer in each genre, i.e. how well he knows when and how loud he should program each note.

6.2 Interdependence of the Parameters in Remote Recording

If the composer uses Remote Recording the following interdependent variables exist:

<u>The room</u> in which the drummer records has an influence on the achievable quality in terms of sound quality and the time needed for the drummer to deliver the recording. The question is: Can the drummer start immediately with the recording or must he first book the room or wait for his time slot? Is the drum-set already set up and miked, or does it have to be first transported into the studio, set up, positioned, tuned and miked?

The <u>financial budget</u> of the composer affects the achievable quality[83]. Most likely it also influences the time until the drummer delivers the recording. Extra urgent delivery costs more for some Remote Recording providers.

The drummer's available <u>time</u> affects the achievable quality, and as mentioned[84], possibly the cost of the composer.

In some cases, the <u>genre</u> can affect the cost. A drummer who has mastered a rare genre may want to have his skills paid.

The <u>achievable quality</u> has a direct impact on the costs. An experienced, reputable top drummer who records in a good studio with excellent equipment and perhaps even with a sound engineer who completes the microphone setup and the mixing, costs clearly more than a semi-professional drummer who records at home with cheap equipment .

As a result, the following picture of mutual interdependence arises as shown in Diagram 3:
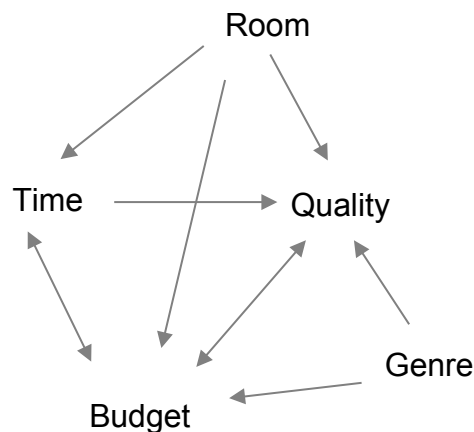
Diagram 3: Graphical representation of interdependencies
of the variables in Remote Recording[85]

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83 see Chapter 5.2.1 Financial Budget

84 see Chapter 5.2.2 Time Budget

85 source: personal analysis

6.3 Variable Analysis Programming versus Recording

As noted with the help of the SWOT analysis in Chapter 5, the most important, mutually influencing variables are time, money, genre and quality. These will now be compared and correlated to each other.

The variable "room" with the subcategories sound, time and flexibility[86] is defined as a constant for this analysis. This is due to the following considerations and relationships: the sound of the room affects the achievable quality, it can therefore be summarized in this topic. The time factor of the category "room" is reflected in the variable "production time", but not in the variable "time required for the composer", and is handled in this analysis as a fixed value.

Predefinition of parameters:
In variable analysis, the assumption will be made that the drummer has his equipment in his own studio and works without a sound engineer. The variable "Experience with Remote Recording" is considered to be fixed, in the sense that the composer already has positive experience with Remote Recording.

6.3.1 Composition of Genre

As already stated[87], the decision to program yourself or use Remote Recording depends on the genre on which the composition is based. If it is a more computer-produced genre such as Techno, House or Dubstep, the quality would be higher with programming than with Remote Recording. This also applies to less experienced composers, since programming is relatively simple. For the genre Film Music it is more about individual percussion instruments (bass drums, snares, cymbals ...) than the drum-set. Again programming is more likely to be the first choice here. If the focus is, however, music such as Pop, Rock, Jazz, Reggae,

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86 see Chapter 5.2 Situational Parameters

87 see Chapter 5.2.3 Musical Genre

Metal, Samba, etc., where a typical genre drum-set sound is expected, high quality results are more likely with Remote Recording.

The genre is thus the first parameter that determines whether to program the drum track or hire Remote Recording. The question that plays a role is how well the composer knows the specific genre and how well and authentic he can program in it.[88]

6.3.2 Financial Budget

As already explained[89], a composer often has the choice as to how to use his production budget, i.e. whether any instruments should be included, and if so, which ones. This means that this variable should actually be called "How much money is a high-quality drum track worth to the composer". It is assumed here that this decision has already been made, and a specific financial budget is available. If the budget is zero, then there is no possibility of Remote Recording, the composer must program for himself.

However, the financial budget can also have an impact if the decision is in favour of programming for himself. The composer can then, with the corresponding budget, purchase a better sounding or genre typical more appropriate library (Diagram 4 shows this relationship).

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88 see Chapter 5.2.3 Musical Genre

89 see Chapter 5.2.1 Financial Budget
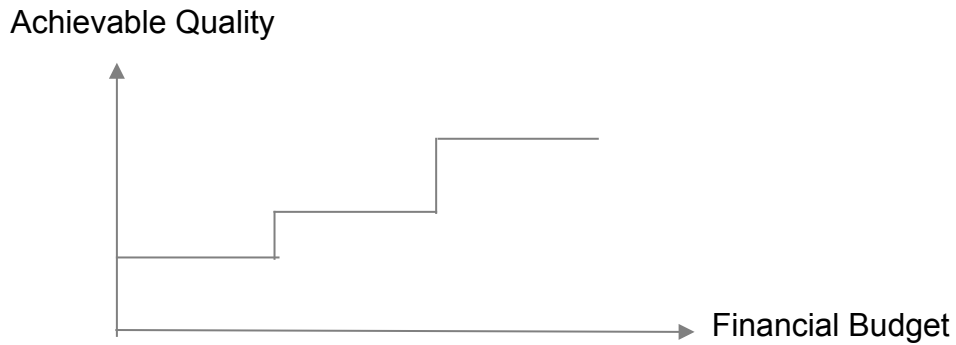
Diagram 4: Tendency of the achievable quality
based on the budget for Drum Programming[90]

It can be assumed that the budget and the quality of Remote Recording are directly proportional. However, there is a wide range of individual offers from drummers who offer Remote Recording.

Remote Recording starts at a certain price value and then increases exponentially (the function is of course not actually exponentially as expressed by a mathematical formula, it's all about the visualization of trends), as the quality cannot be infinitely better and especially in the lower financial sector, the increase in quality is strong (see Diagram 5).
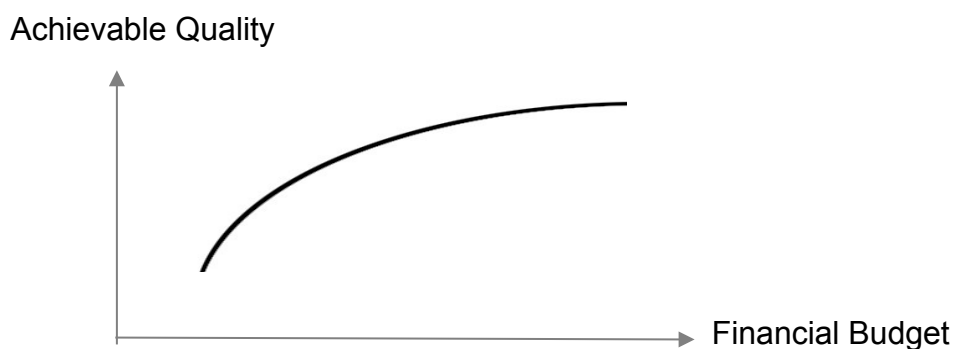
Diagram 5: Tendency of the achievable quality based
on the budget for Remote Recording[91]

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90 source: personal analysis

91 source: personal analysis

The financial budget is also linked with the timing, how much production time the composer has, how quickly the Remote Recording drummer has to deliver. Very fast delivery can mean extra cost.

6.3.3 Time Budget

As previously defined[92], the variable "time" has two meanings:
On the one hand, it's about the time required for programming or for booking Remote Recording. This is actual working time, in which the composer is unable to do anything else. This must be differentiated from the time that it takes for the final outcome to be achieved. The advantage with Remote Recording is that the time, while he is waiting on the results from the drummer, can be used for other activities. The delivery time can be long, but it may be that the composer does not have much time to program the drum track. Maybe he has to invest time in the composition or in the orchestration of the other instruments, or he is working on several jobs simultaneously.

This analysis describes the term "time budget" as the time that the composer has available in order to create a drum track, whether it is with Drum Programming or Remote Recording. If the time budget is very small and the variable Drum Programming has an acceptable quality and is very fast, then programming would be the production method of choice. If more time is available, at least as much to commission Remote Recording, then a tight time budget is an advantage for Remote Recording. With increasing time budget there comes a point (in the diagram, the point T on the timeline) in which both Remote Recording and Drum Programming is possible and the factor time budget is no longer important. Then the decision depends only on the other variables. (Diagram 6 shows this relationship.)

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92 see Chapter 5.2.2 Time Budget
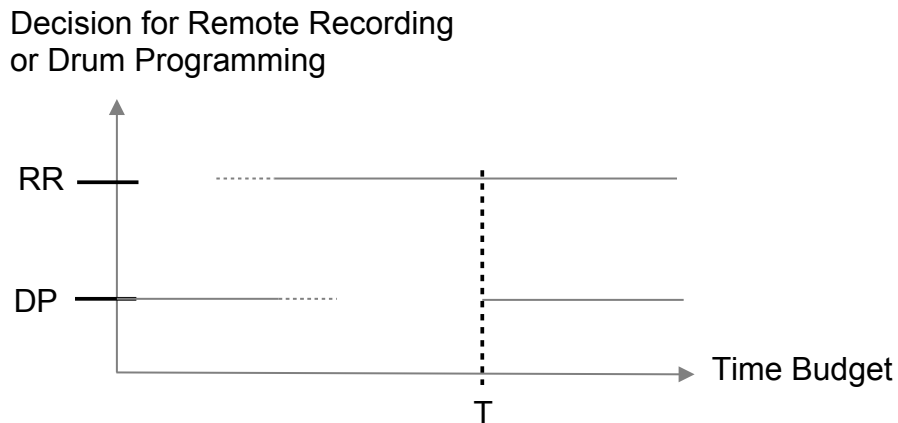
Diagram 6: Decision for Remote Recording or Drum Programming
as a function of the available time budget[93]

6.3.4 Achievable Quality

The quality that the drum track should have is the variable that influences the other parameters the most. In practice, it can be observed that with increasing quality, the choice is rather for Remote Recording, provided that the genre is appropriate.

The achievable quality directly proportionally affects the financial budget. The better the Remote Recording's achievable quality, the higher the price. You need a good drummer, a good studio, good equipment, possibly an extra sound engineer and possibly frequent takes until it matches perfectly and the required quality level is reached. Even with Drum Programming the quality standard is affected by the price but indirectly over the time factor because the composer needs more time to program the details.

Low quality is not necessarily associated with programming yourself. One can, for example, choose Remote Recording due to time constraints because you can find a reasonably-priced drummer that doesn't cost much, because he does not have a high quality.

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93 source: personal analysis

The achievable quality for Remote Recording depends[94] on the drummer's skills and recording setting, for Drum Programming on the composer's skills and the sound quality of his library.

Here a thought experiment: If the quality of the Drum Programming is quite high, then a high quality Remote Recording is also needed (unless the reason for Remote Recording is lack of time) so that this makes sense. And this also has an impact on the financial budget. A composer who has achieved rather poor quality when completing programming for himself, requires less financial budget in order to improve his results, and Remote Recording has a greater effect on him as in the previous case.

If one only considers this aspect, the following relationship is created: With increasing achievable quality of Drum Programming, the possibility of Remote Recording declines. However, this is considered to be one-sided, as in practice many more factors play a role. Often, talented composers expect a higher quality because of their differentiated view and also have more available budget.
What this means is that despite increasing Drum Programming competence, high quality Remote Recording is selected. Diagram 7 shows this relationship but it is only for illustrative purposes to understand the relationship in terms of the previously made points and draws no absolute conclusions.
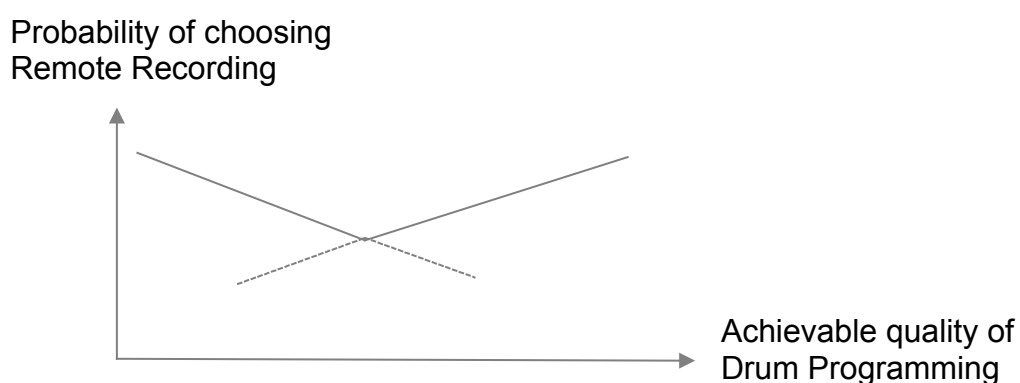
Diagram 7: Decision for Remote Recording or Drum Programming in relation to the achievable quality of Drum Programming[95]

94 see chapter 5.2.4 Achievable Quality

95 source: personal analysis

7. Outlook for the Future

7.1 Development of Sample Libraries

In the development of sample libraries, much has been done in recent years. Music programming has penetrated the amateur and consumer sector. Easy-to-use music programs, which are even available for mobile phones and tablets make creating music a breeze. Loops are mainly used for programming but the programming of drum tracks is often very intuitive with samples. More and more musicians are using the computer to implement their musical ideas.

All this means that the sample libraries market is growing strongly. In particular, many smaller companies, which often consist of only one person, are pushing their products to market. Julian Tauban is an example of such an entrepreneur in drums and percussion. His latest product "Cymbal Rolls" is very innovative. It contains various cymbal rolls whose crescendo can be controlled using the keyboard controller.[96]

The sample libraries are often already so good that they create, with appropriate programming, a deceptively real impression even for experienced listeners.
It is likely that this quality will be further developed making it easier to program. Apple is making great strides towards simplifying the programming. In Logic Version 10 a virtual drummer is integrated, who automatically in true style at the touch of a button provides a drum track that can quite easily be influenced with an array in complexity and dynamic.

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96 cf. www.loopsdelacreme.com, retrieved 1.5.2015

7.2 Market Development of Remote Recording

Remote Recording is in its infancy, as it was only made possible through the spread of the Internet. A strong market development can be observed here. High sophisticated studio equipment is affordable, a main part of the equipment is the already existing computer. More and more musicians offer Remote Recording on their website. Also agency portals such as Session Exchange[97], The Composers Lair[98], Gearslutz[99] or Fiverr[100] offer more and more services from session musicians.

Currently, the spread of Remote Recording is still not very high, rather few composers have had experience with Remote Recording. With the increasing availability, inhibitions on the part of the composer will certainly disappear and the interest to use Remote Recording will increase. Currently, Remote Recording is mainly used as an addition and enhancement of existing programmed music services. But it is easy to imagine and of course already possible to record full albums only with Remote Recording. A contribution to greater publicity and further development of the market is provided by the company Steinberg, who has integrated the Steinberg VST Connect into their DAW Cubase pro 8.

At the end of 2013, Seinberg brought a product on the market that can compensate for some disadvantages of Remote Recording[101]. The **Steinberg VST Connect Pro**[102] is a plugin for the DAW Program Cubase. This product is currently only available for Cubase and not for Logic, Protools or other software. This is however only for the recording composer. The playing musician is not bound to a particular program with the stand-alone Version VST Connect Performer (i.e.

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97 Session Exchange: http://sessionexchange.org, retrieved 1.5.2015

98 Composers Lair: http://www.facebook.com/groups/1461313240803068, retrieved 1.5.2015

99 Gearslutz: http://www.gearslutz.com, retrieved 1.5.2015

100 Fiverr: http://www.fiverr.com, retrieved 1.5.2015

101 This product is not considered in this master thesis, since as opposed to the usual Remote Recording as described in chapter 4 it is not widely distributed.

102 Steinberg, Product homepage Steinberg VST Connect Pro: https://www.steinberg.net/en/products/vst/vst_connect/vst_connect_pro.html, retrieved 12.2.2014

works without DAW program and is available as freeware on the manufacturer's website[103]). VST Connect Pro builds a Peer to Peer connection, the prerequisite is a fast internet connection with minimum 256 kBits/s Upstream. Over a video live-chat connection, the composer can communicate directly with the musician, similar to a studio with a recording room. In this case, both are also sitting in their respective rooms and communicating via Talkback and can see each other through the recording window. Thus, the composer can give feedback to the successful take, the musician does not have to worry about the recording and editing after the setup of the microphone and computers. The playback is also controlled by the composer. The transmission quality during the recording is limited to mp3 up to 320 kHz. When the recording session ends, then the high quality wav. files can be transmitted.

VST connect pro offers a familiar studio setting for small and medium studios that do not have their own recording room. Or even for large studios, who have their own recording room, but for example, would like to record with a musician who is in a different location.

The <u>advantages</u> are:
- Direct communication is possible as in a studio session (the composer can, for example stop the playback if the recording goes in the wrong direction, if there was a play error, etc.)
- The actual amount of time is visible (apart from the time required for the setup). It can therefore be easily charged by the hour, or to work up to a certain level of quality and cost.

The <u>disadvantages</u> are:
- The composer cannot do anything else during the recording. In normal Remote Recording, the musician plays until he is satisfied with the result. So the composer receives a good result without using his own time.

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103 Steinberg, VST Connect Performer:
http://www.steinberg.net/en/products/vst/vst_connect/vst_connect_performer.html, retrieved 1.5.2015

- The musician loses the opportunity to have so many takes done until he is satisfied without time pressure.

7.3 Views Regarding the Topic of this Thesis

Judging from the trend in recent years, the achievable quality of Drum Programming will increase even further and can be implemented with little programming knowledge. This suggests a decreasing use of Remote Recording. On the other hand, a wider choice of musicians and agency portals that offer Remote Recording will also lead to increased use, as the market price will decrease and the inhibition threshold will decline to use Remote Recording services.

It is quite conceivable that within a few years the concept of the virtual drummer[104] will be so developed that a software can analyse the playing styles of famous drummers and be able to retrieve the suitable genre. If the music is already composed, the composer can by using this software allow several drummers to play. This would be analogous to the procedure of booking multiple Remote Recording drummers, but their results are instantly available at your fingertips. Lehmann developed, with regards to the interaction of a conductor with a virtual orchestra, the idea to vary volume, balance and tempo changes of the piece during a performance[105] with the help of a remote control as a baton and a conductor platform that responds to shifts in weight. This idea can certainly be transferred to Drum Programming.

Ultimately, the question, with regards to Drum Programming or Remote Recording, comes down to how replaceable is a musician by the machine "computer". Hans Zimmer, one of the best known and most successful film composers nowadays,

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104 see Chapter 7.1 Development of Sample Libraries

105 cf. Lehmann, 2012, p. 21

answers this question: "There's nothing that can replace the human soul in a score[106]".

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106 cf. Karlin, 2004, p. 269

8. Summary

This master thesis compares Drum Programming and Remote Recording, provides an analysis of strengths and weaknesses from the perspective of the composer. It becomes apparent that the decision to personally program the drum track or to take advantage of Remote Recording is multidimensional with variables that influence each other.

The decision depends essentially on how high is the achievable quality of the respective production modes, how much worth does this quality have for the composer (financial budget), how much time is available and which genre is being used for the composition. Furthermore, the composer's personal preferences and room conditions (both the composer's and the recording drummer's) all play a role. The composer's experience with Remote Recording also influences the decision.

The achievable quality of Drum Programming depends, on one hand, on the composer's genre competence and on the other hand, on the achievable sound quality. The latter depends on the sound quality of the library in conjunction with the composer's programming ability. The achievable quality of Remote Recording depends on the drummer's musical competence (technical musical skills and genre competence) and the achievable sound quality. The latter depends on the room conditions, the recording equipment used and the quality of the instruments.

For the composer, the variable "required time" is genre dependent (e.g. a House music drum track can be programmed faster than a Jazz track) and depends on how quickly a composer can program a drum track. The production time depends on whether the drummer has his own studio with a drum-set that is already set up and microphoned and how quickly he can provide useful results. This means that with extreme production stress Drum Programming has time advantage. If a little more time is available (according to the genre and the composer's programming skills) then Remote Recording has the advantage. When the time budget exceeds a certain level then time is no longer a decision parameter.

Benefits of Drum Programming are the lower cost and ease of making subsequent changes. The advantage of Remote Recording is the higher achievable quality, provided that the genre requires a realistic naturally (acoustic) sounding drum-set.

9. Appendix

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9.2 List of Figures and Diagrams

9.3 Glossary

A/D converter: Analogue/digital converter, a circuit that converts continuous signals, which originate from the analogue level into discrete digital numbers.[107]

Bit: Smallest unit of a digital value

Click track: A Click-track (often abbreviated to Click) is a computer-generated or a metronome generated ticking which specifies the beat and the exact tempo progression of a music piece. For live productions, the musicians and - if available - the conductor listen during the recording with headphones to the click in order to prevent tempo changes and to ensure the synchronization of music with the picture.[108]

DAW: Digital Audio Workstation. This is a software used in music production. It can be used to record and edit audio signals as well as to edit MIDI commands i.e. control the sample library, this is called programming. The most common DAW programs are Logic (Apple), Cubase (Steinberg), Protools (AVID), Studio One (PreSonus) and Live (Ableton).

Drum Programming: Generation of a drum track on the computer

Drum track: Acoustic or programmed recording of a drum-set

Fill: Variation and loosening of the rhythm

Groove: Describes either the rhythm of a single instrument or the entire rhythmic basis of all the instruments playing together.

MIDI: *"Musical Instrument Digital Interface, [...] is an industry standard for the exchange of musical control information between electronic instruments such as*

107 cf. Katz, 2010, p. 395

108 cf. Katz, 2010, p. 395

keyboards or synthesizers. This standard includes the exact nature of the required hardware and the protocol for transmitting data. MIDI 1.0 was introduced in August 1982."[109]

Mockup: More or less finished produced piece of music that the composer uses to communicate with the client.

Plugin: "*An additional process that can be inserted into a DAW."[110]*
This can either be an effect (equalizer, compressor, reverb, etc.) or a tone generator such as a sample library.

Pre-Amp: Pre-amplifier, which converts a weak microphone signal into a more processible signal.

Programming: In a narrower sense, it means music production using a sample library. In a broader sense, this term includes the use of audio loops.

Remote Recording: Method for recording vocals and instruments in which the musician records in his own studio to the music of the composer and the result is delivered over the internet.
The term Remote Recording is also used by some companies for a mobile recording setting. Often they are large audio engineering companies who offer to record concerts with mobile recording equipment at the concert's location. This type of Remote Recording is not the subject of this master thesis.

Sample Library: Collection of audio files that with help of a computer can be played with a keyboard. The audio files are usually recordings of single tones of acoustic instruments in different dynamics.

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109 Wikipedia, http://de.wikipedia.org/wiki/Musical_Instrument_Digital_Interface, retrieved 1.5.2015

110 Katz, 2010, p. 399, translated from German

Setup: With respect to drums it is the way that the drum-set is assembled, which drums and cymbals are used and where they are positioned. The set-up is very individual and varies from drummer to drummer.

Talkback: Intercom in a studio between recording and control room

Take: An instrumental recording. Often, the drummer plays several takes, from which the best version is selected.

9.4 Overview Drum Sample Libraries

An overview of current available drum sample libraries, this list is not exhaustive.

Native Instruments:
Studio Drummer
Abbey Road Series (Vintage -, 50's -, 60's -, 70's -, 80's- , Modern Drummer)
Drum Lab
Battery

8Dio
Zeus

Spitfire Audio
Hans Zimmer Percussion Los Angeles

East West
Stormdrum

Toontrack
EZ Drummer, Superior drummer

XLN Audio
Addictive drums (Oyster Kit, Brushes Kit, Jazz Kit, Indie Kit, ...)

Loops de la creme
80's Snares, Cymbal Essentials, Kick Pack Deluxe, Cymbal Rolls

Spetrasonics
Stylus RMX

9.5 Equipment List Remote Recording

This is my equipment that I use for Remote Recording. The equipment used is of course different from drummer to drummer, this list is only for rounding off the view into the topic Remote Recording.

Drums:
Sonor Prolite: 22x17,5", 10x8",12x9",16x16"
Yamaha Maple Custom: Absolute 20x16", 10x8", 12x9", 14x12"
Gretsch 70th's Jazzset: 18x14", 12x8", 14x14"
8 different Snare Drums: small to large, wood, brass, steel
Cymbals: Bosphorus, Zildjan, Meinl, Istanbul, Wuhan, Paiste

Percussions:
Cajon, Congas, Bongos, Timbales, Djembe, Darabouka, Small Percussions
(Shaker, Cowbell, Triangle, ...)

Recording Equipment:
A/D - Interface: RME fireface 800, Focusrite Octopre MKII
Mikrophones: AKG D112, C214, C1000, Audix D2, D4, I5, Shure SM57
Monitorspeakers: Adam A5X
DAW: Logic 9.1 (plugins: Lexicon Hall, Waves CLA-drums, Slate Digital Trigger, ...)

Studio: 20 m² studio, sound optimized

Fig. 13: Studio of Remote Recording Drummer Andy Winkler[111]

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111 Winkler, http://www.andywinkler.com, retrieved 1.1.2015