Tampere University of Applied Sciences

Techniques for Affordable DIY Home Recording

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Media and Arts
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ABSTRACT

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The aim of the thesis was to produce a single for the punk rock band Euroopan Valot. The author's role in this project was to be the producer, recording engineer and mixing engineer. All compositions and lyrics were created by Juha "Juffe" Putkonen. The production of the single was conducted in a self-built recording studio owned by the producer and mixing engineer.

In the thesis, the recording techniques of different instruments are covered, as well as the mixing and mastering of the single using affordablye priced equipment. The instruments recorded for the thesis include electric guitar, bass guitar, vocals, harmonica, acoustic drums, maracas, and tambourine. The aim was to create a single that would replicate the sound and vibe of 1980s Finnish punk rock using DIY techniques and affordable recording equipment.

The thesis is targeted towards musicians, studio technicians, and other music industry professionals interested in DIY and affordable recording options. The recording techniques discussed in the thesis can be applied in various recording projects.

Key words: punk, DIY, affordable, recording techniques, music production

CONTENTS

ABBREVIATIONS AND TERMS

DAW	Digital Audio Workstation
EQ	Equalizer, an audio tool that can be used to adjust the volume of different frequencies
Hz	Hertz, the derived unit of frequency
KhZ	Kilohertz, equal to 1000Hz
Plugin	An audio processing software that can be used within the DAW

1 INTRODUCTION

Euroopan Valot, a punk rock band, was founded in 1990 in Seinäjoki, Finland. The band's inspiration was drawn from some of the most popular ‘80s Finnish punk rock bands like Pelle Miljoona, Ratsia, Ypö-Viis, and Eppu Normaali. The band had been on hiatus for many years due to other projects pursued by the band members, such as Too Sophisticated, Mad Hounds, and Fobia. At the start of 2022, an idea for creating the band's first-ever record was conceived by drummer Juha Putkonen (Peter Lilvis), who reached out to his friends Mike DeLight, Raise, and Viki Rock from former bands Too Sophisticated and Fobia. In the middle of 2022, I was contacted by Juha Putkonen and informed about his single idea.

In the past, my background primarily lay in electronic music production, although I had also had a few opportunities to delve into producing punk music. These experiences not only expanded my skill set but also deepened my appreciation for the raw energy and authenticity that defined the punk rock genre. As the project was planned by myself over a few days, it was noted that my expertise in electronic music production, coupled with an understanding of punk's ethos, could bring a unique and dynamic perspective to the creation of the single. Therefore, an agreement was reached with Juha to serve as the producer of the single.

After a few months of planning costs, style, timetables, and other pre-production matters, it was agreed to produce a 3-song single titled “Luotuja Kulkemaan.” During the pre-production phase, it was observed that the band’s name was Peter Livlis & Euroopan Valot, and a suggestion was made to Juha Putkonen that the band name should be more commercial. Consequently, it was agreed to change it to simply Euroopan Valot. In July 2022, production of their album commenced in my own DIY recording studio in Seinäjoki, Finland.

2 DIY

DIY, or “do-it-yourself,” culture is popular among musicians all over the world. Especially in the punk scene, where people are usually poor, unemployed, and critical of modern consumer politics, the DIY culture encourages people to make music themselves. By cutting out the need for a record label or professional studio, the DIY musician’s expenses and incomes become more manageable because the artist controls everything. DIY artists, or “cultural entrepreneurs,” take on the position and responsibilities of an independent artist primarily for exposure and networking purposes. (Morris, 2014.)

PICTURE 1. DIY punk music culture and DIY clothes (DIYconspiracy.net)

2.1 DIY culture

According to folk singer and peace activist Ian Campbell, in the mid-fifties, there was a phenomenon that became bigger than the jazz scene itself. It was called the skiffle craze. Skiffle was a primitive do-it-yourself (DIY) jazz music played with homemade rudimentary rhythm instruments, with a singer singing jazz songs in a simple, repetitive style.

Assistant Professor Emit Snake-Beings points out October 1976, were both now-famous British music magazines, Melody Maker and Sounds, released extensive articles in which Caroline Coon, a political activist, artist, and journalist, used the phrase “Do it Yourself” and was one of the first people in history to do so, according to Jon Savage, a music journalist at that time. Savage mentions this in punk rock culture in 1976 and refers to the “Do it Yourself” term as seen in an article in the magazine Sniffin’ Glue by Mark P., referring to the people in DIY magazine production culture called fanzines. (Snake-Beings, 2016.)

PICTURE 2. UK Music Fanzines from 1976 to 90’s (Duncan Illing)

2.2 DIY history

According to sociologies And Bennett and Paula Guerra, at the beginning of the twentieth century, the term DIY was invented by people interested in creating, repairing, and/or modifying things without using an expert in that field. DIY evolved from these early times through decades to adopt different cultural methods. (Bennet and Guerra, 2018.) In the 1950s, an artistic and cultural movement called Situationist International used satire to critique and condemn the inconsistencies within capitalist consumer society by crafting countercultural artistic creations that challenged cultural depictions and employing innovative communication forms like manifestos, zines, and various mediums. The aim of these new forms of communication and interaction was to evoke a sense that the ordre des choses (system) could be altered. Two decades later, the DIY ethos of the Situationist movement found a vibrant resurgence in punk—a movement that brought together the sensitivities and aesthetic understandings of the youth during a pivotal socio-economic crisis. (Bennett and Guerra, 2018.)

While punk originated in the United States in the mid-1970s, its significance as a form of resistance among disenchanted and disillusioned youth became evident several years later when British audiences first encountered punk music and culture. In this context, punk emerged as a striking platform, both visually and sonically, expressing the anger and discontent of youth while inadvertently serving as a conduit for fear and moral panic.
What further contributed to punk's appeal for both musicians and audiences was its DIY quality. While earlier musical styles, such as skiffle and rock 'n' roll, had also showcased a distinct DIY character, punk's entire musical and cultural ethos was deeply imbued with a robust and unmistakable DIY aesthetic. (Bennet and Guerra, 2018.)

By the time punk emerged, the popular music industry had reached a stage where the production and distribution of popular music were tightly regulated and highly standardized. Music was being created on a mass scale, calculated to appeal to broad audiences. From the punk perspective, this level of regulation resulted in

music losing its connection with its audience, consequently stripping away its social, cultural, and political value. Punk's primary mission, therefore, was to reintroduce music to an aesthetic reminiscent of the excitement of the rock 'n' roll era while simultaneously reintroducing a political message. In a musical historical context, the DIY (Do It Yourself) culture has played a crucial role in shaping various genres and movements. (Bennet and Guerra, 2018.)

The DIY ethos in music is characterized by independent, self-released, and self-produced projects that often operate outside the traditional music industry. DIY bands rejected mainstream music conventions and embraced a raw, independent, and self-sufficient approach. They often recorded their own music, created handmade album covers, and distributed their records through independent channels, contributing to the establishment of independent labels and DIY recording studios. (Bennet and Guerra, 2018.)

3 PRE-PRODUCTION

According to Grammy award-winning engineer Dom Morley before starting the main step of recording audio in a studio environment, the first essential step at the recording studio is pre-production. This step is a remnant from the past when studios were expensive, and studio time was limited. The pre-production usually happened at the rehearsal room with the band, so it was easy to walk into the studio and start recording the songs straight away without delay. Nowadays, the pre-production part is not necessary because almost every studio has a computer-based DAW system used in music production. Pre-production is still used nowadays to remove unnecessary hassle, and being prepared for the recording by pre-production makes the recording event more pleasant for the band and the producer. (Morley, 2021.)

According to studio engineer Neil Rogers Pre-production usually starts with a conversation with the artist in question. During the conversation, the producer decides on a starting point for the production: what kind of equipment to use, where to put what in the DAW, and whether to use a click track during the recording procedure. The discussion with the artist also includes arrangements and experimenting with different tempos for a particular song. Additionally, a key point in the pre-production discussion is to understand the artist's musical inspirations and ensure that both the artist and the producer are on the same page. During the same session with the artist, it is good to think about mic selections and how to approach the initial recording session from a technical point of view. (Rogers, 2017.)

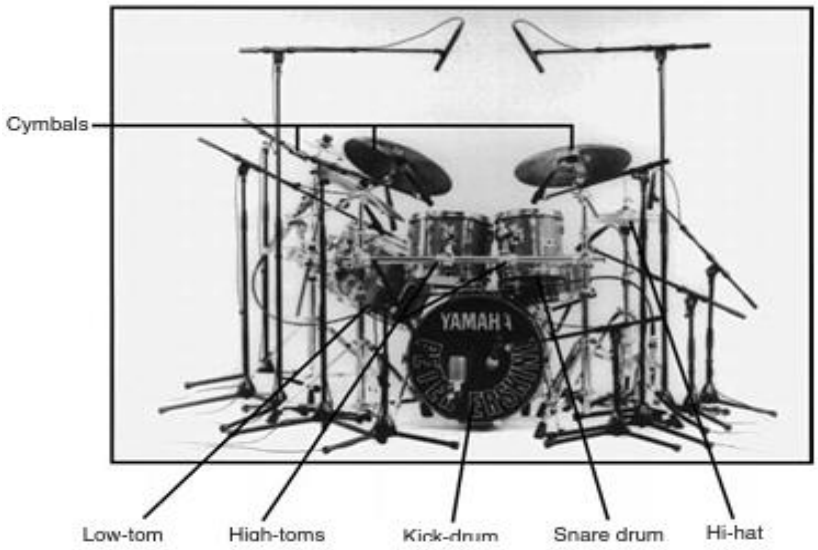
PICTURE 3. Tommaso Colliva a Grammy Winning, engineer, mix engineer and remix artist uses detailed planning documentation in pre-production (soundonsound.com)

4 PRODUCTION

According to award-winning sound designer Nick Messitte it's crucial to ensure your recording system is rock-solid and reliable before any client session. Perform disk-utility tasks and defragging well in advance. Avoid upgrading your operating system just before a session; stick with a trusted and learned OS. Prepare the appropriate project folder with clear labeling for each track, indicating the instrument, take, and date. Confirm the preferred sample rate with the client to avoid future issues. Archive every file from every session and regularly test the reliability of your hard drives. Utilize familiar gear and software to streamline the recording process and achieve the best sound efficiently. Always provide a quality headphone mix for the client and have a backup plan in place for equipment failures, such as preamp issues, patch bay malfunctions, faulty cables, or computer/audio interface failures. (Messitte, 2017.)

4.1 Drums

According to SAE Institute lecturer Marcel Bellvé when starting to record the drums, it is best to evaluate prior experience when deciding how many and which microphones are going to be used in a drum track. Using many microphones could lead to problems that are difficult to solve, so using a few or more microphones with overall good quality is the best and easiest way for a drum track recording. Recording acoustic instruments such as drums, it’s important to remember that the instrument sound is impacted by the composition, types of microphones, and the material of the recording room. Also, microphone placement is important because the further the microphone is placed from the drum kit, the greater is the impact of the environment on the overall sound. (Bellvé, 2015.)



PICTURE 4. Miking drumkit (beyerdynamic.com)

4.1.1 Kick

Producer Rob Toulson refers to the importance of drum tuning before recording any tracks. Before recording any kick drum track, it is vital to tune the kick drum right. The frequency of the kick drum can be anything from around 55 Hz to around 80 Hz for standard 24”, 22”, or 20” drums, and even higher for smaller 18” or 16” kick drums used in some jazz drum kits. With standard tom drum overtone frequencies between around 80 Hz and 120 Hz, the kick drum RTF value of 1.4 or 1.6 works well. (Toulson, 2021.)

According to producer Mike Senior when recording kick drum, the choice of the drum, its tuning, and preparation has a big impact on the captured sound. There are many different models on the market, but many producers such as Steve Albini, Roy Thomas Baker, Steve Churchyard, Bob Clearmountain, Elliot Scheiner, Steven Street, etc., rely on the AKG D12 large-diaphragm dynamic microphone and its successor, the AKG D112. The reason for the use of these microphones in kick drum recording is their tight cardioid directional characteristic and ability to withstand high sound pressure (SPL) levels. One of the biggest reasons for using these mentioned microphones when recording the kick drum is their special resonant chamber, which adds weight at around 100 Hz. In addition,

the AKG D112 microphone also adds a presence boost at 3 kHz, making it, according to Alan Parsons, “the punchiest mic I’ve found”. (Senior, 2008.)

PICTURE 5. Typical microphone placement for recording the kick drum. The microphone in use is a drum microphone, Shure Beta 52A (shure.com)

4.1.2 Snare

One of the most used microphones for recording snare drums is Shure’s SM57. The 1965 legendary microphone is used by many famous producers like Steve Churchyard, Bob Clearmountain, and Tony Visconti. These producers use the SM57 for recording both upper and lower drumheads. When placing the up-close snare microphone in a spatially restricted place, the Shure SM57’s low end of 200Hz and its minimizing kick-drum spill is an appealing choice. The 300-500Hz drop and 2-12kHz presence peak reduce muddiness of the sound and add more “snap” to the snare drum recording. The Shure SM57’s cardioid pattern is referred to as tight, which means that it helps reduce spill from other drums like hi-hats located nearby. (Senior, 2008.)

PICTURE 6. Microphone placement for recording snare. The microphone in use is Shure Beta 57A (shure.com)

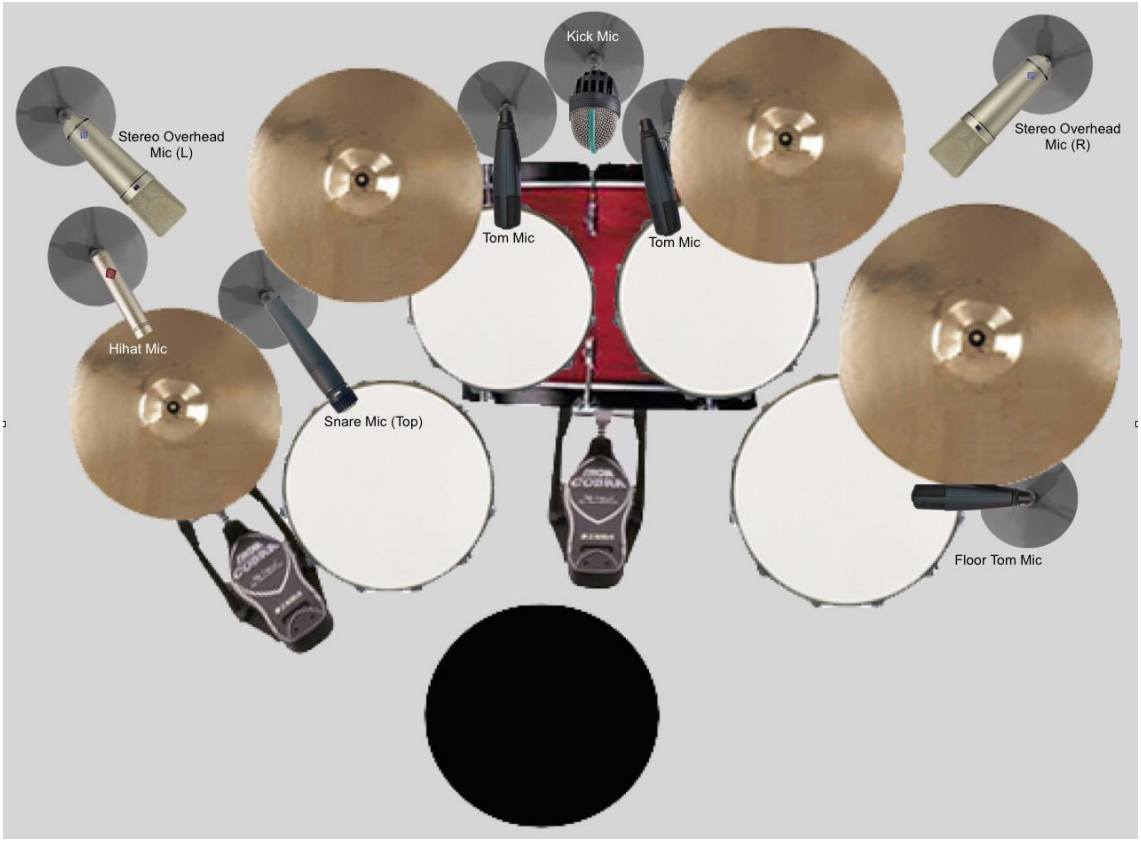
4.1.3 Toms

According to Sound Operations Lecturer Hugh Robjohns when recording toms, the microphones are placed close to the upper heads of the toms or on the rims of the toms. This presents a problem in the recording situation because of the spill of the microphones. The more microphones are open at the same time, the more spills are created in the overall recording, and the harder it is to balance the kit. Using audio gating can remove the unnecessary audio spill when there is no wanted sound entering each microphone. But when using this technique, audio gating cuts off the opening transient of the sound that is wanted, thus changing the body of the sound and making the sound feel more artificial and processed. The best technique for miking the tom-toms is to position dynamic microphones over the rim close to the center of the heads and angle up to nullify the close by cymbal as much as possible. Hypercardioid microphone patterns usually work best in this role. (Robjohns, 2003.)

PICTURE 7. Recording toms with gooseneck condenser microphone, Shure PGA98D. The microphones are connected to the rim of the toms (shure.com)

4.1.4 Hihats

According to composer David Mellor a typical drum kit contains at least four elements of cymbals: crash, ride, and upper and lower hi-hat. When recording the drums, the hi-hat pair is the most important of the four cymbals after the bass and snare drum. Cymbals are directional instruments that radiate the sound upwards, so if the mics are positioned near the rim of the cymbal, in this case, the hi-hat, the sound spill will be minimized. (Mellor, 1990.)



PICTURE 8. Hi-hat miking technique with left/right overhead and hi-hat microphone (macprovideo.com)

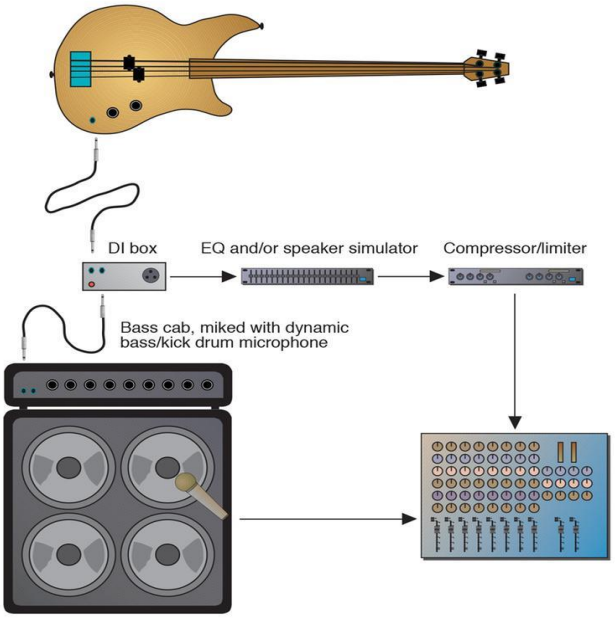
4.1.5 Room

When recording drums, the great-sounding room is a big part of the successful process. With little knowledge of mic techniques, a good room can make the capturing of the drum sound almost effortless. When recording drums, the goal is usually to get the most tight/dry drum sound as possible and, at the same time, adding depth by capturing the ambience of the room. The depth can be easily achieved by using artificial reverb on the drum close mics. (Rogers, 2015.)

4.2 Bass guitar

According to Sound on Sound Executive Editor Paul White the good bass sound in a track starts with a quality instrument. There are two ways to achieve the wanted result. One method for recording the bass is to use DI with at least 500kΩ input impedance. Usually, all active DI boxes feature this requirement. The other way is to mic the bass amp. When recording in this manner, a quality bass amp

is needed, along with a working environment where it is possible to play the bass amp loud enough to achieve the desired sound through a microphone. The general-purpose dynamic vocal microphone is usually enough to capture the sound, and usually, these microphones have a low-frequency option to compensate for use in proximity. According to P. White, some of the best bass guitar sounds come from using tube amplifiers. A tube amplifier is an electronic bass or guitar amplifier that uses vacuum tube technology to increase the amplitude or power of a signal from a bass or guitar. (White, 1999.)



PICTURE 9: Two basic approaches for recording bass guitar (Google Image)

Musician Joe Albano mentions that the best way to record a great bass sound with a good low-end sound is to use a miked-up bass amplifier and a DI box together. This will produce a clean and round sound with depth from the DI box and edgier midrange punch from the miked amp to the bass sound. (Albano, 2015.)

4.3 Electric guitar

According to Paul White, the traditional method for recording the electric guitar is to mic a good amplifier with a good microphone. When recording electric guitars, the appropriate mic placement is important. A lot of sound comes out directly from the rear of the amp, but also some of the sound is directed to the back and sides

of the amp. The open-backed amp also emits sound from the back of the cabinet almost as loudly as from the front. Recording electric guitar can be done by using almost any good microphone, producing a result usable in the track as it is. According to White, British recording engineers usually use cardioid and dynamic microphone models, while American recording engineers often opt for capacitor microphones. The dynamic mic is known to produce a smoother and more solid high-end sound, while the capacitor microphones produce a more open and brighter sound. (White, 2002.)

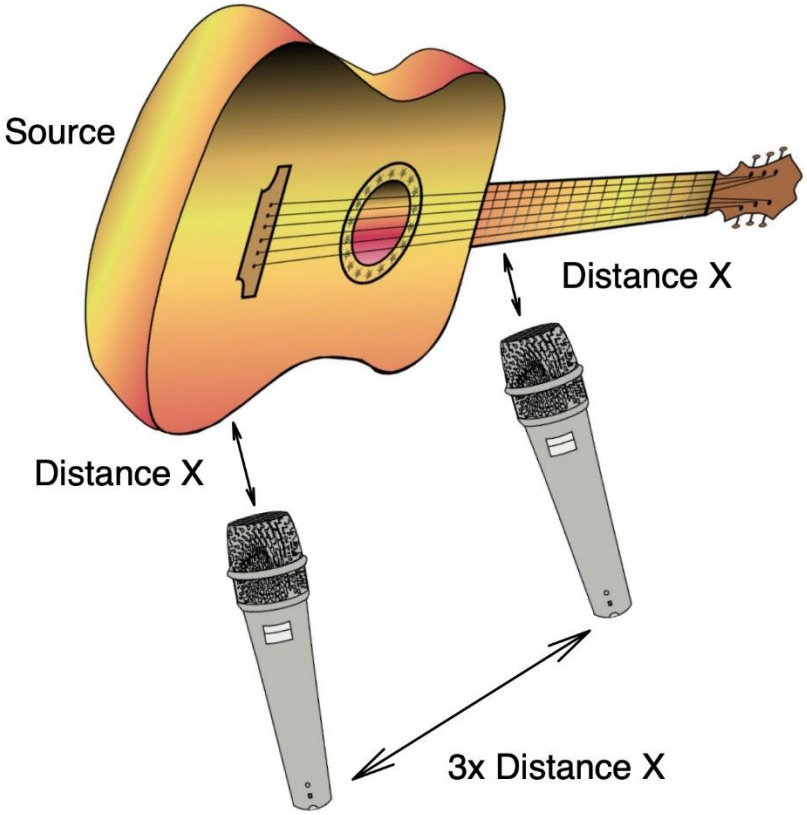
PICTURE 10. Mic placement on a speaker (Google Image)

As guitar amps normally use 10 or 12-inch speakers without tweeters or crossovers, they are limited in the upper frequency response. These guitar amps can be used singly or in multiples, and either in sealed cabinets or open-back cabinets. The open-back cabinets usually have different low-frequency characters compared to closed cabinets because there is no air trapped inside the cabinet. (White, 2002.)

4.4 Acoustic guitar

According to music technology expert Mitch Gallagher there are several different miking techniques for recording acoustic guitar. One of the common techniques is to place one microphone in front of the guitar, a little further back, and the second microphone to the player's right-hand side, a little bit in front, so the two

microphones form a triangle with the player's right ear and the front microphone. The right mic is usually on the knee level upwards to the guitar body behind the bridge or at the ear level facing down from the body of the guitar to the bridge. In this setup, the main sound of the guitar comes from the front mic, and the right-hand microphone will produce the tight bottom end of the sound with rounded lows. This technique is usable with almost any acoustic guitar, from steel to nylon-string guitars. According to Gallagher, experimenting with the different mic positions is the key to success. (Gallagher, 2004.)



PICTURE 11. Recording technique for acoustic guitars (yamaha.com)

4.5 Harmonica

Singer, songwriter David Greeves points out that depending on the genre of the music in question, there are two options for recording the harmonica. The first option is done so that the microphone is off the stand, and the player holds the microphone in his or her hands with the harmonica below the microphone. This technique creates a more pure and natural sound used in pop, jazz, folk, and

classical music. The second method is for the player to play in front of the microphone on a stand. According to Greeves, a jazz harmonica legend, Toots Thielemans uses a handheld Shure SM58 for the first option, but when recording harmonica and aiming to get the sound out as natural as possible, a good starting point is to use a stand-mounted good quality condenser microphone. When recording the harmonica, the handheld option may seem like an easier option to isolate any outside distractions from the recording, but it is not usable in some cases when adding different harmonica playing techniques and expressions. When using the technique where the mic is on a stand in front of the player, the mic should be placed at least 15cm distance from the player to capture the external vibrato of the harmonica. The microphone stand should also be adjusted so that the microphone's end is at the same height as the player's mouth and pointed at the source of the sound, in this case, the back of the hands. (Greeves, 2013.)

PICTURE 12. Miking technique for capturing harmonica (Anne Hamersky)

4.6 Maraca

Often, recording a hand percussion instrument like maracas is more challenging because the sound levels aren't high. The sensible technique for recording usable material is to use a close-miking approach, but because the maraca player is constantly moving while playing, the better option is to use distant mic placement

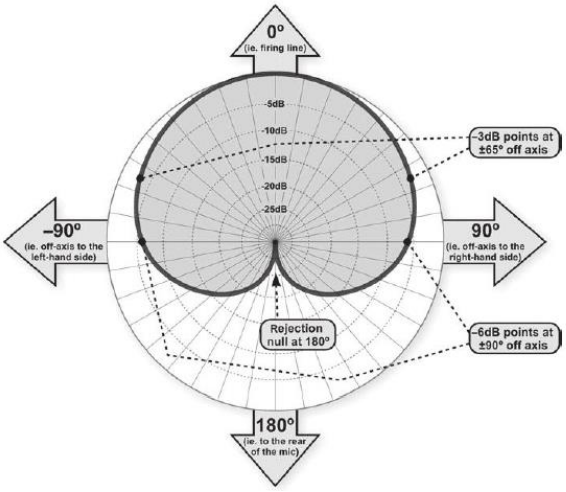
technique. Using mic placement requires a microphone with a wide range of frequencies; typically, a capacitor microphone with less than 17dB EIN and low self-noise would be a good choice for the recording. According to Hugh Robjohns, recording small percussion instruments involves a lot of transients, so a capacitor microphone is the best option, although because of the cheaper ribbon microphones in the market nowadays, these microphones are becoming a more popular option for recording small percussion instruments because their sound is smoother and more natural compared to capacitor microphones. When recording a small percussion instrument, the sound of the room plays a key role in either enhancing or degrading the recorded sound, so it's usually a good technique to record the sound dry and add ambient reverb after recording. You can also place a broadband absorber behind the microphone if the recording is getting too much room sound when using a ribbon microphone. A good mic placement is key for successful recording, and one usable location for finding a sweet spot for the microphone is to place the microphone over the player’s shoulder. (Robjohns, 2008.)

PICTURE 13. Miking techniques for hand percussion (Google Image)

4.7 Vocals

According to Recording Engineer Mike Senior the common choice for recording vocals is to choose a condenser or capacitor microphone for the recording because these types of microphones add low levels of noise to the output signal. Usually, it is preferred to use a condenser microphone because it has a thin diaphragm which moves fast enough and provides high-frequency response, so it captures even the quietest voice cleanly. When choosing the condenser microphone for vocal recording, it is critical also to notice the size of the diaphragm because larger diaphragms typically have lower noise and greater inertia, making the recording sound softer and smoother. (Senior, 2014.)

When recording vocals, it is also important to take notice of the recording room's reverberation. If the room has reverb, the production can sound cheap, and the vocals could be pulled backward in the mix. Also, dynamic processing of the vocals can sound less natural, and pitch-correction software will not work correctly. When the singer is recording the vocals on-axis in front of the microphone, the off-axis room reflections are reduced by using a directional microphone whose sensitivity moves away as the singer moves off-axis. The most typical type to use in this situation is the cardioid type. (Senior, 2014.)



PICTURE 14. Microphone inverted heart shape cardioid pattern (Google Image)

5 POST-PRODUCTION

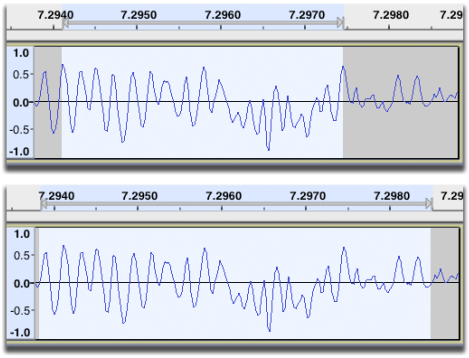
According to Audio Engineer Frank Demilt, post-production in music production refers to the stage of the production process that occurs after the recording phase. It involves various tasks aimed at refining, enhancing, and finalizing the recorded tracks to achieve the desired sound and quality. Post-production typically includes activities such as editing, mixing, and mastering. (Demilt, 2021.)

5.1 Editing

Producer Simon Langford mentions that the most basic editing techniques in the modern studio DAW environment, according to Langford are cutting, copying, pasting, and moving techniques. The situations where you will use these techniques are almost limitless, from timing correction to repetition of different sections of the song or simply removing unwanted ambient noise in the quiet parts. When editing a song, cutting, copying, pasting, and moving are fundamental techniques that allow you to rearrange, modify, and manipulate audio segments. These actions are commonly performed in digital audio workstations (DAWs) and audio editing software. Before starting the editing of the recorded material, it is good to stop for a moment and think how close do you want the edited material to be compared to the original recorded material. (Langford, 2014.)

According to Langford, handling the 'Zero-Crossing' edits are perhaps the most important things when making any editing, particularly if making edits in the middle of the word/sound/note. 'Zero-crossing' editing is a technique used in audio editing to minimize or eliminate audible artifacts that may occur when making cuts or edits within a waveform. The term 'zero-crossing' refers to the points in an audio waveform where the signal crosses the zero-amplitude line (the point of no displacement or neutral position). These points are crucial because they represent moments when the audio signal is at its minimum, and editing at these points helps avoid abrupt changes in the waveform that can cause clicks, pops, or other unwanted artifacts. The primary goal of zero-crossing editing is to ensure smooth transitions when making cuts or edits in audio recordings. It helps

prevent audible glitches that may arise when the editing point is not aligned with the zero-crossing points. (Langford, 2014.)



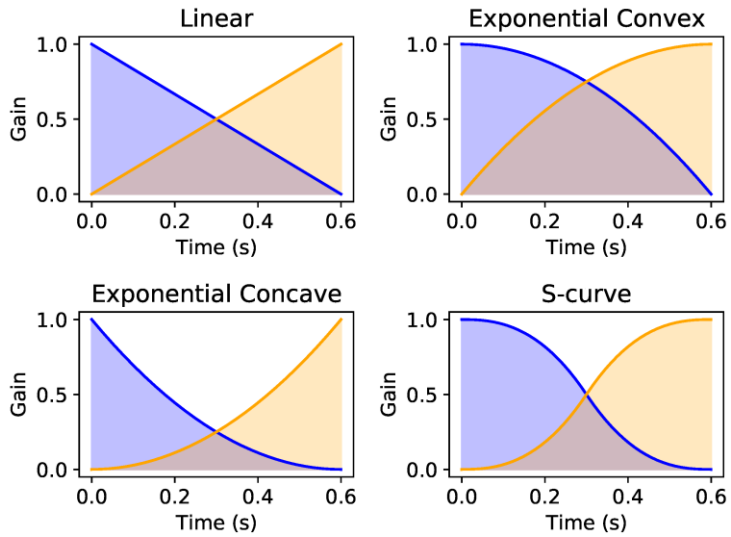
PICTURE 15. Example of “Zero-Crossing” edit in Audacity (Audacity team)

According to Langford (Langford, 2014), as Zero-Crossing is important when editing, so are equally important techniques in editing, such as the use of fades and cross-fades. These techniques allow the beginning and the end of audio regions to sound smooth without glitches. Fades and crossfades are used to control the volume levels of audio signals over time, and they serve different purposes. The difference between these two is functional. A fade involves gradually increasing or decreasing the volume of an audio signal. It's a smooth transition between silence (fade-in) or a sound to silence (fade-out). When there are no overlaps, the regular fade is used. A cross-fade involves blending the end of one audio clip with the beginning of another. It's a technique used to create a seamless transition between two adjacent audio regions. (Langford, 2014.)

When the goal is to fade from one region to another on the same track, then a cross-fade is the technique to use. Understanding these differences is crucial when editing audio, as both techniques are valuable tools in creating professional and seamless sound productions. When using fades and cross-fades, there are different “shapes” (or curves) to be used. Different fade shapes refer to the various ways in which the amplitude of an audio signal changes over time during a fade-in or fade-out. (Langford, 2014.)

The choice of fade shape can significantly impact the perceived quality and character of the transition. Some of the common fade shapes are Linear Fade, Exponential Fade, S-Curve Fade. Linear Fade is the simplest fade shape, where

the volume changes at a constant rate. Exponential Fade, where the curve follows an exponential function, resulting in a gradual acceleration or deceleration of the volume change. The S-Curve Fade combines elements of both linear and exponential fades, resulting in a curve that resembles the letter 'S.' When choosing a fade shape, considering the context and the desired effect for your specific audio project is the key for using the different fades correctly. Different shapes can be used to match the natural characteristics of the audio material or to create specific artistic effects in music or sound design. (Langford, 2014.)



PICTURE 16. Linear Fade, Exponential Fade and S-Curve Fade (MDPI.com)

5.1.1 Cutting

Cutting involves removing a selected portion of audio from the original location, useful for removing unwanted sections, creating edits, or preparing clips for rearrangement. (Langford, 2014.)

5.1.2 Copying

Copying involves duplicating a selected portion of audio, enabling the duplication of sections within the same track, across different tracks, or for backup before making edits. (Langford, 2014.)

5.1.3 Pasting

Pasting involves placing a copied or cut section of audio at a new location, allowing you to place duplicated or previously removed sections at specific points in the arrangement. (Langford, 2014.)

5.1.4 Moving

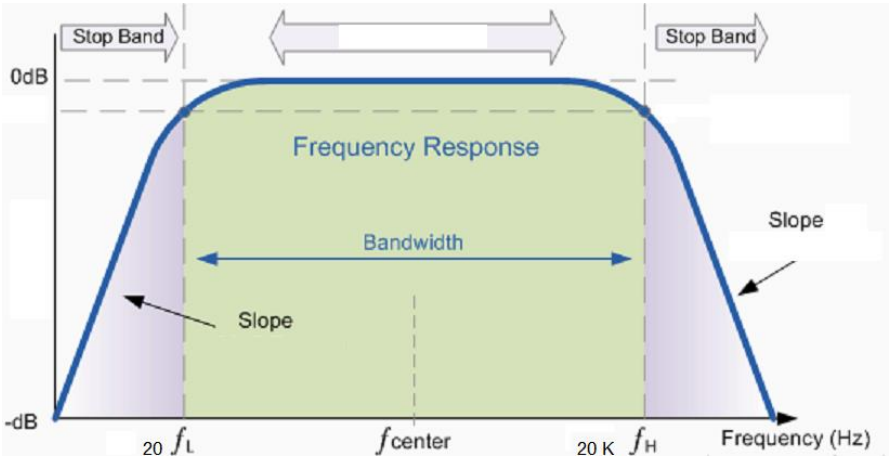
Moving involves relocating an entire audio segment to a different position in the timeline, useful for rearranging the order of sections, adjusting the timing, or experimenting with different arrangements. (Langford, 2014.)

5.2 Mixing

When mixing a pre-recorded track, it is important to have good speakers (nearfield monitors) to hear the mix properly. There are two choices for main speakers in the studio: active speakers and passive speakers. When on a tight budget, the unfortunate truth remains that monitoring is an aspect of audio technology where financial investment significantly impacts the quality. This is especially true when considering your studio's main monitoring system, which must deliver accurate mix details alongside a relatively balanced frequency response across the broad audible spectrum of 20Hz to 20kHz—a set of features that often requires a considerable investment. Active or powered speakers, which feature built-in amplification, are a smart choice for home studios. (Senior, 2018.)

They offer convenience and space efficiency, eliminating the need to match amplifiers with specific speaker models. Additionally, their typically heavier build enhances cabinet inertia, particularly in response to woofer movements. Moreover, many of these designs incorporate separate matched amplifiers for each individual driver unit, resulting in performance enhancements. Monitoring selection often is at the end a personal preference. Some people lean towards bright and aggressive-sounding monitors, while others prefer more restrained and understated ones. Neither preference is inherently incorrect. It's essential to

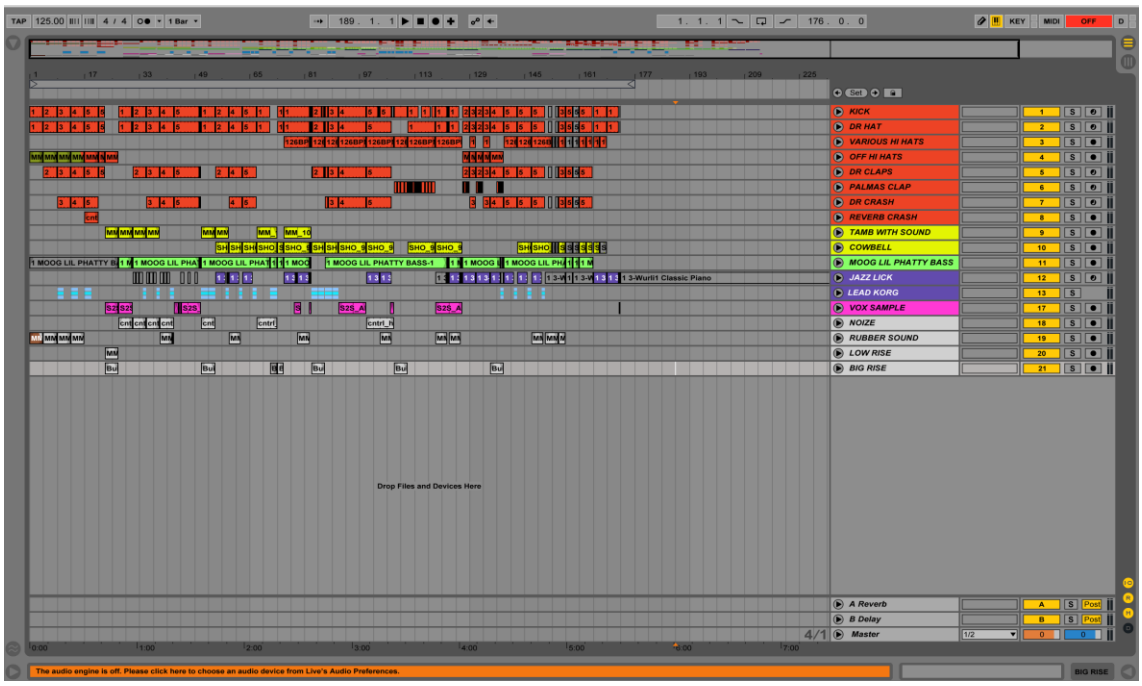
recognize that no monitors can claim absolute neutrality and there are no correct ones and only speaker model or brand to choose. (Senior, 2018.)



PICTURE 17. The hearing range of human ear from 20Hz to 20kHz (google.com)

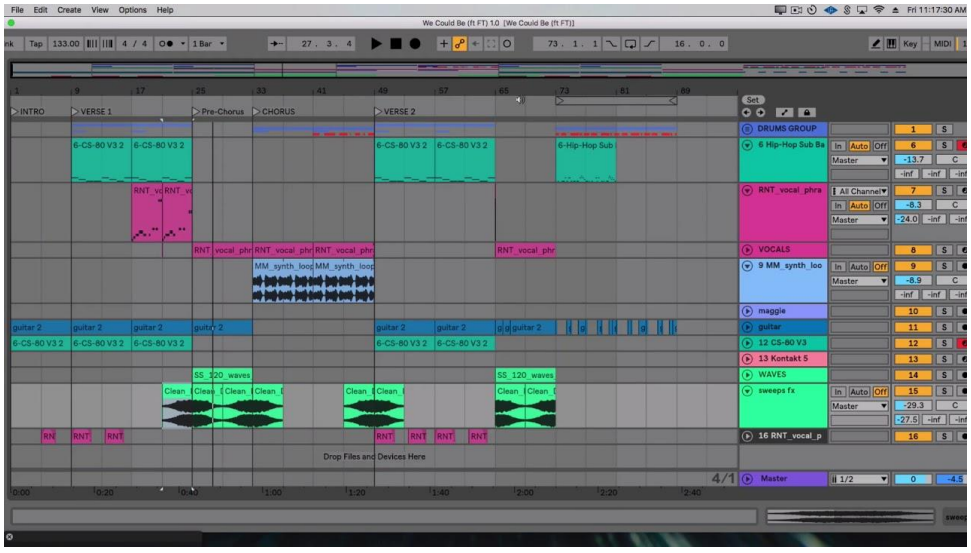
5.2.1 Organizing Tracks

Before starting the mixing process, a good method for keeping the navigation in the project and the layout as simple as possible is to organize the tracks. This essential step ensures that you can locate essential elements such as kick drum, bass guitar, lead vocals, or any other instrument easily in the project. This process entails placing the most significant instruments within easy reach and consolidating larger groups onto fewer mixing channels, making it easier to control multiple elements of the project simultaneously. As part of the task of organizing tracks, it is recommended also to name the tracks accordingly and use different colors for different instrument groups. (Senior, 2018.)



PICTURE 18. Example for organizing instrument groups in Ableton Live by using different colors (flypaper.soundfly.com)

The mixing process usually requires extensive listening to specific segments of your mix and comparing various sections of the song with each other. Having a clear understanding of the musical structure of the production and its correlation with the playback timeline can significantly reduce frustration during this process. As such, another step in the organizing process is to mark the musical structure of the project. (Senior, 2018.)

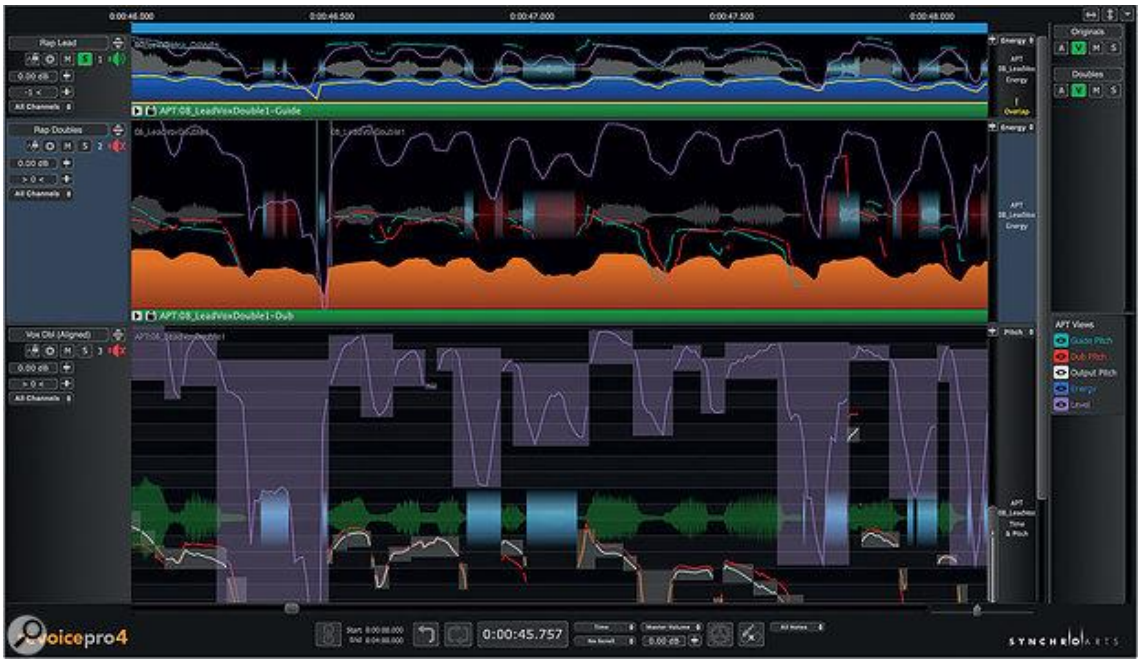


PICTURE 19. Using markers in Ableton Live to identify the musical structure of the project (Dan Giffin)

5.2.2 Timing and Tuning

There is often a lack of proper attention to details regarding tuning and timing in many small studios, which can reduce the commercial competitiveness of the production compared to more commercial big studio productions. Correcting these issues may be time-consuming, but it is an essential step in competition with the more expensive commercial recording studios. When trying to maintain the groove of the mix, it is beneficial to designate a single instrument, often the drums, as a timing reference. (Senior, 2018.)

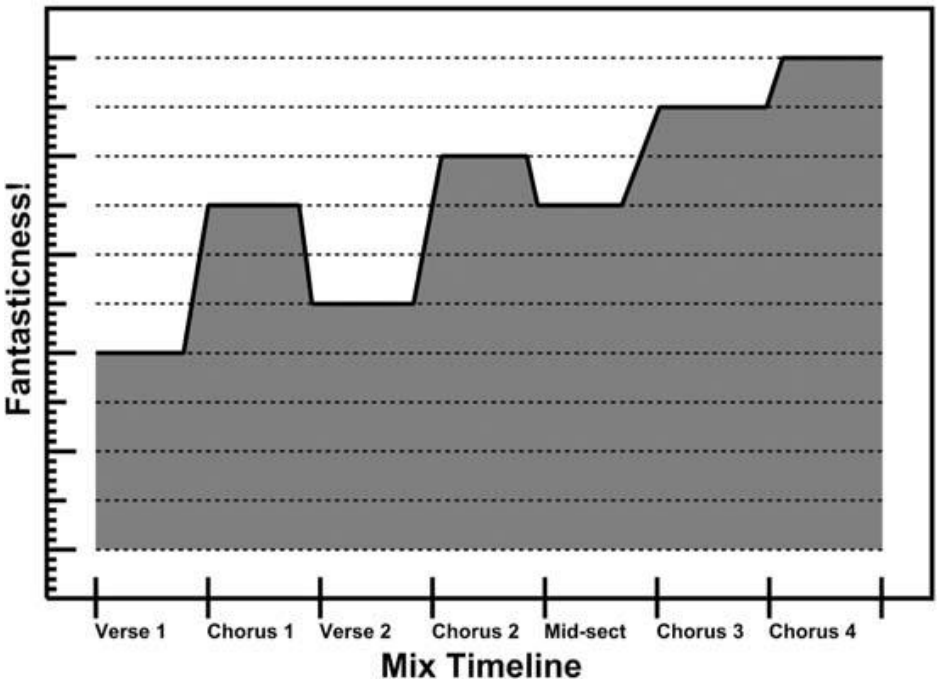
The timing is refined as needed and then aligned with other parts of the project, particularly those performed sloppily, to match. Rhythm tracks usually benefit the most from the tightest timing adjustments. Lead vocals can also affect the overall groove, so they should be edited accordingly if necessary. When timing and tuning bass instruments, the producer should pay attention to the ending of the notes. Usually, simple cut-and-crossfade editing techniques are often enough for most of the timing corrections, and the most usable locations for editing are in silences, noisy signals, or pre-masked locations. Time stretching can be a useful tool for gap-filling, and most of the DAWs on the market provide this built-in processing. Tuning and timing issues are usually both musical and mixing problems, so paying attention to the issue is critical in the project. (Senior, 2018.)



PICTURE 20. Revoice Pro 4 by Synchro Art is a good tool for applying automatic timing and tuning to vocals. (soundonsound.com)

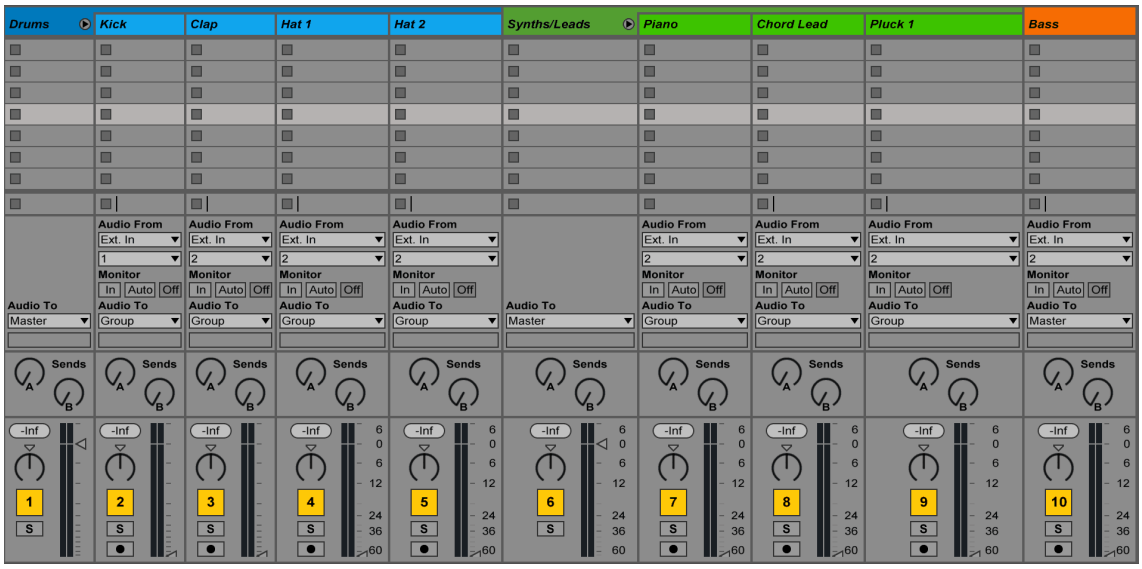
5.2.3 Balancing

When starting the balancing of the mix, the first step is to put all the faders down from all the channels inside the DAW. At this point, it is good also to check that there are no unused channels, and if there are, remove them. The order in which you mix the project's different instruments and sections is important because it can have a significant impact on the final project. To start mixing the project, it is important to recognize the different sections of the song's emotional high points, build-ups, and drop-downs. (Senior, 2018.)



PICTURE 21. Recognizing different sections of the song is a key for a good dynamic mix (M. Senior)

Most common difficulties in mixing are verses sounding bigger than choruses. To minimize this problem, it is good practice to work with the project in order, starting from the important section of the song and mixing sections of the song from there to the least important part. The balancing starts by mixing one instrument at a time in order of importance to the whole project. (Senior, 2018.)

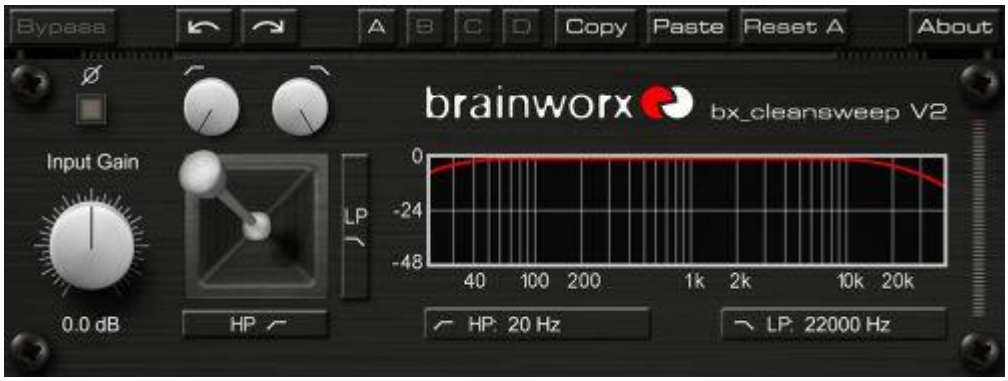


PICTURE 22. The mixer channels in Ableton Live before starting the balancing step (edmprod.com)

5.2.4 High-Pass Filtering

After successfully balancing the track, the next mixing task is to clean up the low end of the track using a high-pass filter. This is done in a digital studio by using an EQ VST plugin. The purpose of this task in the mix is to remove the unwanted low frequencies that can disturb the whole mix. This process gradually diminishes the low-frequency range below a user-defined "cut-off" or "corner" frequency. The extent to which low frequencies are reduced beneath the cut-off point increases progressively, typically measured in decibels per octave. Some advanced high-pass filter designs offer users the ability to control this attenuation. While certain filters feature slopes of 72 dB/octave or greater, these may introduce problematic audio results. (Senior, 2018.)

According to Senior, it is better to use relatively moderate filter slopes of 6, 12, and 18 dB/octave (also known as 1-, 2-, and 3-pole designs, or first-, second-, and third-order filters) for general mix cleanup tasks. (Senior, 2018.)



PICTURE 23. Brainworx bx_cleansweep is a popular free Hi-Pass and Lo-Pass filter plug-in for Windows and MacOS. There is also a paid Pro version available. (kvraudio.com)

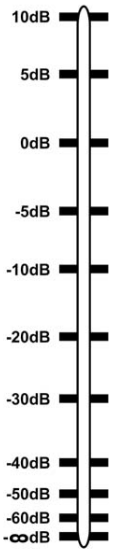
5.2.5 Panning

After the high-pass filtering is done, the next task is to set the panning of different channels. The function of a pan control on a mono track involves adjusting the signal level it distributes to the left and right channels of your mix. When panning

the track hard left, all its signal is directed to the left channel; when panning hard right, all its signal is directed to the right channel. When listening in stereo, panning a track to the center typically results in it seeming approximately 3 dB quieter compared to panning it hard to one side. When adjusting the panning of any track away from center, it's essential to consider how its balance will alter in both mono and single-sided stereo. This adjustment could result in a significant 3 dB level decrease in mono and could potentially cause an instrument to vanish entirely. (Senior, 2018.)

5.2.6 Level Setting

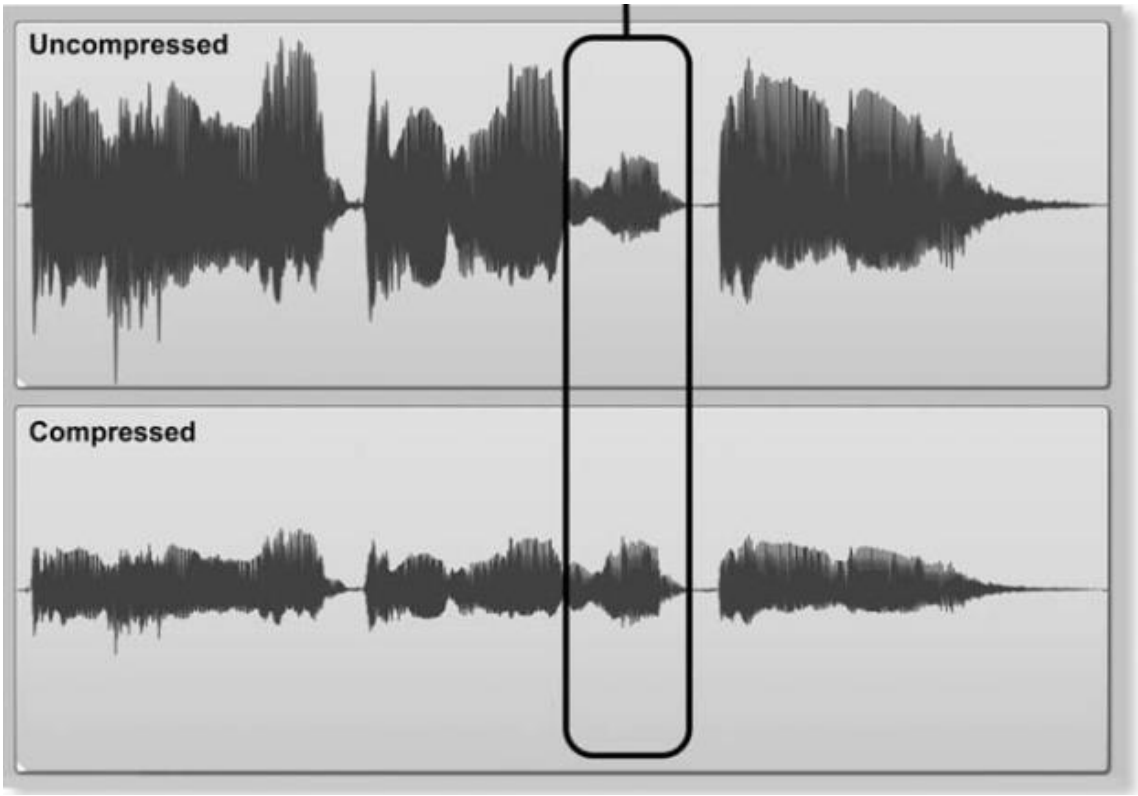
Following high-pass filtering and panning, the next step in mixing the project is to adjust the levels appropriately relative to your mixing system’s headroom. This ensures that you avoid distorting the entire arrangement. Most modern DAWs use a DSP calculation method that provides unlimited headroom and a non-existent noise floor, meaning that when mixing, it is possible to overload the level meters on every channel of the mix. After that, you can simply reduce the DAW's master output, so the mix won’t suffer any distortion or quality loss. But according to Senior, it is better to try to avoid overloading channels and busses in the mix. (Senior, 2018.)



PICTURE 24. Fader control scale. Movements around 0dB are more precise in gain changes than movements at the bottom of the scale (Senior)

5.2.7 Compression

One of the key mixing techniques is the correct usage of compression. The compressor is basically a fader that automatically moves around in real time. Compressor aids in the mix by preventing instruments from losing their position in the balance of the mix. For example, in a lead vocal recording, when a fader is set in a position on the fader scale so that the majority of the vocals are audible in the mix, the lower-level vocals begin to fade into the background in the overall mix because the difference between the highest and lowest signal levels is too large. Using a compressor on the vocals reduces the level differences between lower and higher-level signals so that it is easier to find a fader setting that works for all vocals in the track. (Senior, 2018.)



PICTURE 25. Compression can help rebalance relative levels of the vocal track. (Google Image)

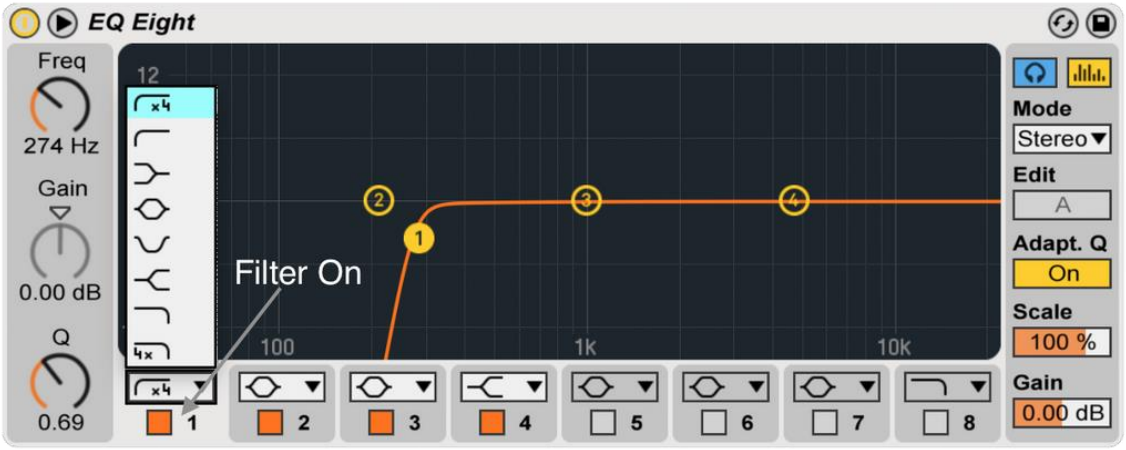
The aim of a good mix is to have a balanced sound between different instruments. So, before starting to compress different tracks, it's essential to consider which tracks need compression and which ones don't. For example, according to Randy Staub, a well-known award-winning Canadian recording engineer, and Joe

Barresi, an American recording engineer and producer, electric guitars rarely require much compression because the sound is already compressed coming out of the speaker. One reason to use compression in a track generally is to reduce the difference in levels but also to minimize the need for adjusting faders, thus maintaining the overall balance of the track. So, it's important to carefully consider which tracks need compression and which ones don't. (Senior, 2018.)

5.2.8 Equalizing and Frequency Masking

After successfully compressing the needed tracks, the next task is to use an equalizer and also the technique called Frequency Masking to adjust different frequency regions compared to each other. Frequency Masking is a psychological phenomenon that affects the listener's perception when hearing multiple instruments playing together at the same time. For example, mixing drums with cymbals filling the frequency spectrum above 5kHz, noticing the lead vocal part in the overall mix is less easy, as the cymbals tend to overshadow the vocals above 5kHz. (Senior, 2018.)

This phenomenon is referred to as "masking." To maintain a consistent vocal sound despite the presence of cymbals, you'll need to either decrease the levels of the cymbal frequencies above 5kHz or enhance those frequencies in the vocal sound. When using Frequency Masking, it is important to understand that even if each instrument individually in the arrangement sounds good on its own, it is crucial to use equalization if necessary to counteract frequency masking between the instruments, ensuring that each instrument retains its distinct tone within the final mix. (Senior, 2018.)



PICTURE 26. One of the well-known Equalizer is the Ableton Live EQ Eight (productionmusiclive.com)

5.2.9 Reverb and Delay

After getting a good balance in the overall mix and ensuring every track is heard clearly without masking each other, the next task is to add some extra effects if needed, such as reverb and delay. There are five main aspects to the reverb effect that can affect the mix simultaneously. (Senior, 2018.)

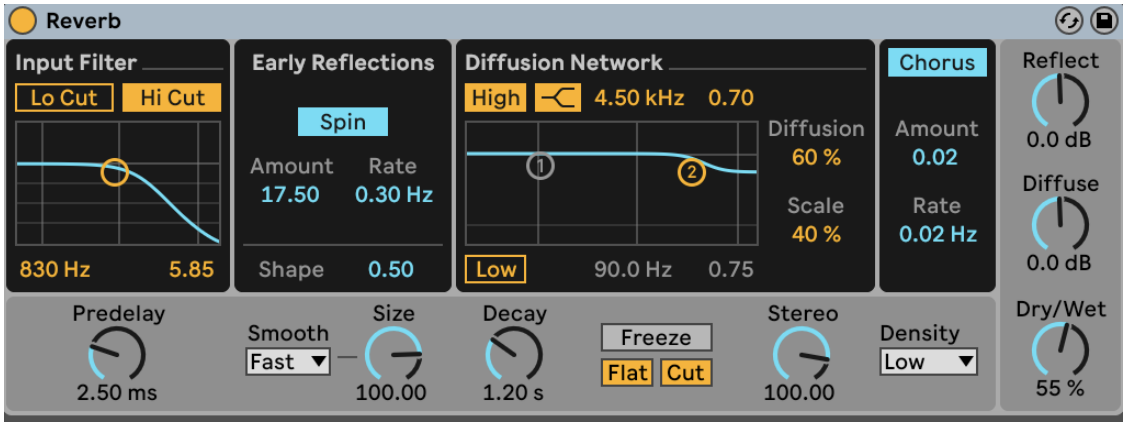
- Blend: Reverb enhances the degree to which each individual track integrates with the overall production, creating a sense of unity among different instruments and contributing to a cohesive sound throughout the mix. (Senior, 2018.)

- Size: Reverb has the ability to expand the perceived dimensions of your mix's acoustic space, creating the impression that your tracks were recorded in a larger, potentially higher-quality room than they actually were. This technique can elevate the perceived production value of low-budget projects, giving them a more luxurious sound. (Senior, 2018.)

- Tone: Once added to the mix, the echoes comprising a reverberation effect have the potential to phase-cancel with the dry track. (Senior, 2018.)

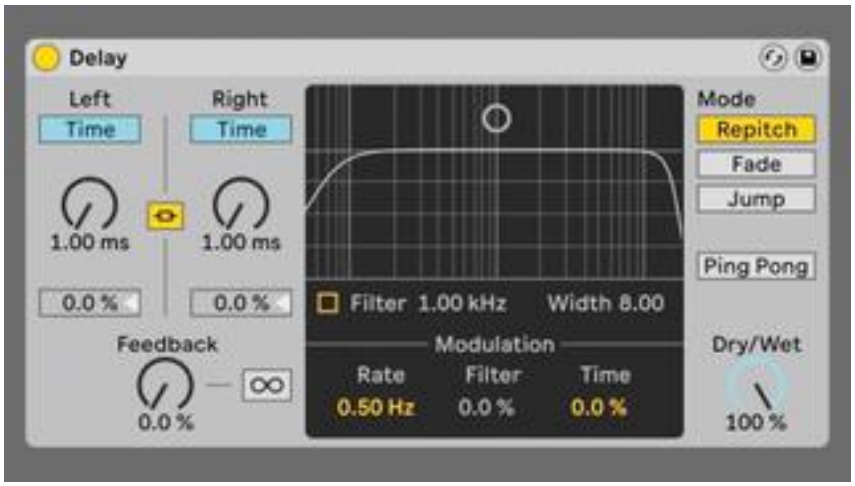
- Sustain: Echoes are essentially delayed copies of the effect's input, thereby causing any reverberation to effectively enhance the sustain of a dry sound it is applied to. (Senior, 2018.)

- Spread: In most artificial reverberators, simulated echoes are dispersed across a significant portion of the stereo image. This distribution helps evenly spread information throughout the audio landscape, potentially amplifying the perceived stereo width of individual processed tracks, as well as the overall mix. (Senior, 2018.)



PICTURE 27. Ableton Live has a great built-in Reverb plugin (ableton.com)

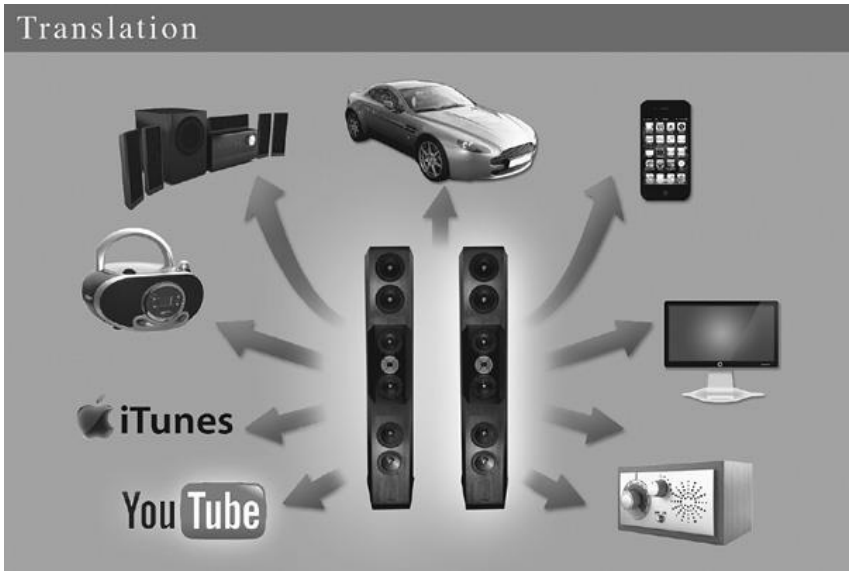
After successfully inserting reverb for a more professional sound in the overall mix, the next task is to use delay if needed. The delay effects are usually simpler than reverbs, so according to Senior most of the small studio mix engineers choose to use only reverbs in the mixing tasks. There are two main controls for delay: Delay Time and Feedback Level. The Delay Time control sets the time delay between the dry sound and the first echo, while the Feedback Level decides the number of subsequent echoes that ensue after the initial one and their rate of decay over time. (Senior, 2018.)



PICTURE 28. The built-in Delay plugin in Ableton Live offers the controls for Delay, Time and Feedback Level. (musicradar.com)

5.3 Mastering

According to Mastering Engineer Gebre Waddell after completing the mixing task, the final step for production is to master the project for finalization and preparation for transferring the project to CD, vinyl, or another final medium. The mastering goal is to ensure the best quality sound on different music playback systems. According to Waddell, the mixing engineer of the project's producer usually doesn't perform the mastering of the project and usually trusts the mastering to someone else with experience in mastering. (Waddell, 2013.)



PICTURE 29. The goal of the mastering is to make sure that the sound of the recording has the best sound possible on various playback systems (Waddell)

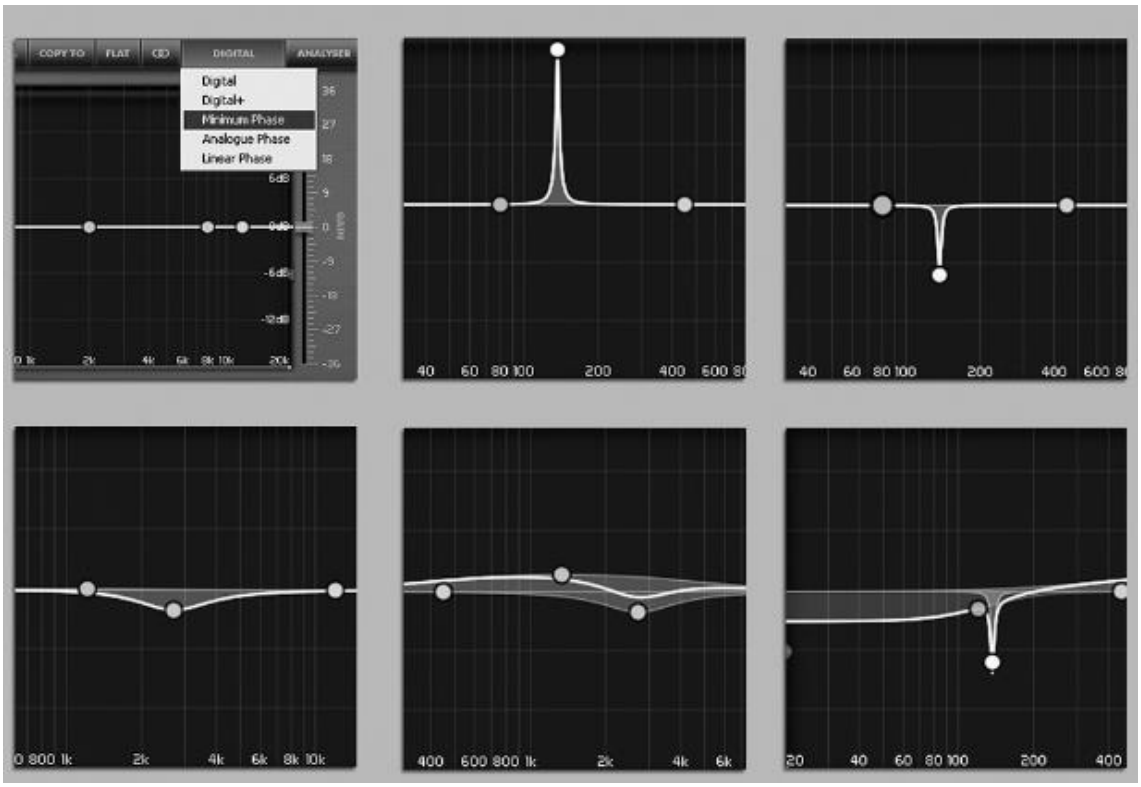
5.3.1 Mastering Chain

According to Waddell (Waddell, 2013), a starting point for mastering is to build a working mastering chain. This includes placing equalization, limiting, and dithering plugins on the track. The correct sequence of the plugins is crucial in mastering. (Waddell, 2013.)

5.3.2 Equalizer

The equalizer serves as the primary plugin for fine-tuning tone, a crucial aspect of the mastering process. According to Waddell (Waddell, 2013), to reduce any resonant frequencies, the lower midrange should be set between 120-400 Hz, and the Q value of the equalizer should be within a range of 1-4. Unlike resonant frequencies, harshness is a frequently encountered issue. To mitigate harshness, employing a parametric equalization bell at 3.15 kHz with a Q value of 3.5 will reduce the harshness of the sound. (Waddell, 2013.)

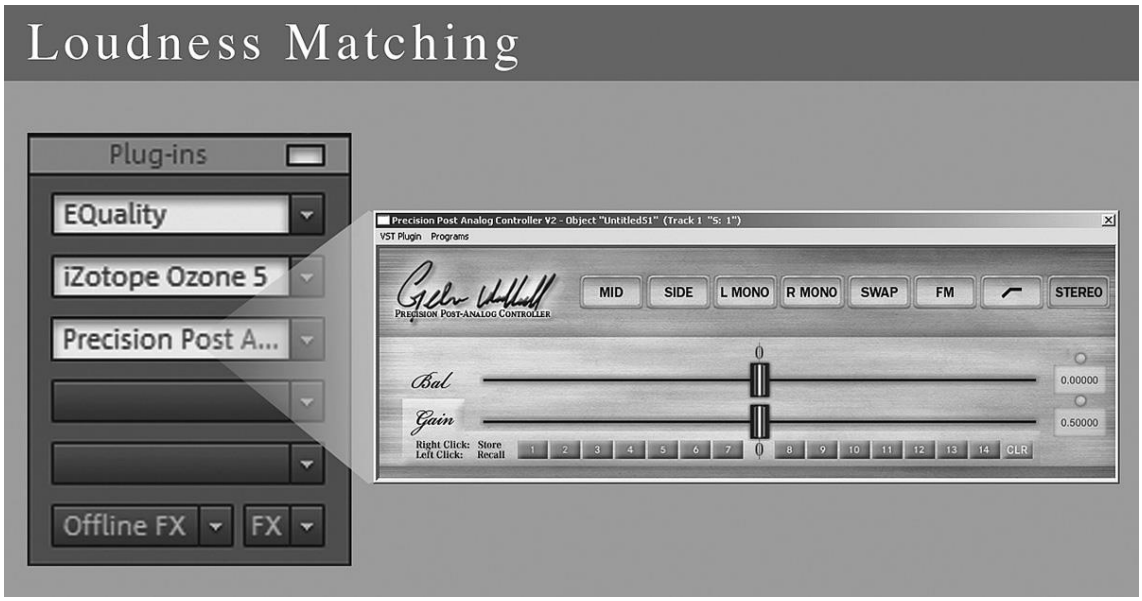
For broader adjustments across extensive portions of the spectrum, consider using a bell with a wider width (lower Q value). It is recommended to utilize shelving filters to modify complete frequency ranges, such as the entire bass range (120 Hz and below) or the entire high-frequency range, if required. (Waddell, 2013.)



PICTURE 30. Find resonance and cut 3kHZ using shelves to adjust (Waddell)

5.3.3 Limiter

Limiters are audio processing tools equipped with two key settings: a gain control and a ceiling. The gain control regulates the volume of the recording, while the ceiling establishes the highest permissible level. In shaping perceived loudness, the gain control carries more weight than the ceiling. This is because the average level plays a larger role in determining perceived loudness than the maximum level. The gain control of the limiter should be adjusted for each track to ensure that, when listening, each track exhibits the same or similar loudness. (Waddell, 2013.)



PICTURE 31. Matching the loudness using Gebre Waddell's Precision Post-Analog Controller (Waddell)

5.3.4 Dithering

Dithering involves adding noise to audio when converting from a higher bit rate to a lower one. It's applied as the final step before down sampling. This step is crucial, as mastering processes usually occur at 32 or 24 bits, while the final output is typically 16 bits. Many limiters and most digital audio workstations (DAWs) include dithering functionality. (Waddell, 2013.)

6 RESULTS

The production of the single "Luotuja Kulkemaan" for the punk rock band Euroopan Valot showcases the power of DIY home recording techniques and demonstrates how high-quality music can be created on a budget. Founded in 1990 in Seinäjoki, Finland, Euroopan Valot drew inspiration from notable ‘80s Finnish punk rock bands such as Pelle Miljoona, Ratsia, Ypö-Viis, and Eppu Normaali. After many years of hiatus due to the members' involvement in other projects like Too Sophisticated, Mad Hounds, and Fobia, drummer Juha Putkonen (Peter Lilvis) sparked the idea to record the band's first-ever single at the start of 2022. He reached out to former bandmates Mike DeLight, Raise, and Viki Rock, and in mid-2022, he contacted me to discuss the project.

Although my primary background was in electronic music production, my previous experiences with punk music had expanded my skill set and deepened my appreciation for the raw energy and authenticity of the genre. Recognizing that my expertise in electronic music production, combined with an understanding of punk's ethos, could bring a unique and dynamic perspective to the single, Juha and I agreed that I would take on the roles of producer, recording engineer, and mixing engineer for the project.

After several months of careful planning, including discussions on costs, style, timetables, and other pre-production details, we decided to produce a three-song single titled "Luotuja Kulkemaan." During this phase, we also agreed to simplify the band's name from Peter Livlis & Euroopan Valot to Euroopan Valot for greater commercial appeal. Production began in July 2022 in my self-built DIY recording studio in Seinäjoki, Finland.

The aim of this thesis was to document the techniques and processes used to produce the single, focusing on how basic recording and mixing techniques can be effectively utilized with budget-friendly equipment. The instruments recorded for this project included electric guitar, bass guitar, vocals, harmonica, acoustic drums, maracas, and tambourine. The key techniques used during the production were:

- Compression was used to manage the dynamic range of the recordings, ensuring that each instrument and vocal track maintained a consistent level without unwanted peaks or dips. This helped in achieving a balanced and professional sound.

- Equalization (EQ): EQ was applied to shape the tonal balance of the tracks. This involved boosting or cutting specific frequencies to enhance the clarity and presence of each instrument, ensuring they fit well together in the mix.

- Balancing: Balancing the levels of the various tracks was crucial to ensure that no single element overpowered the others, creating a cohesive and harmonious mix.

- Frequency Masking: This technique was used to prevent different instruments from clashing by occupying the same frequency range. Careful EQ adjustments ensured that each instrument had its own space in the mix.

- Timing and Tuning: Ensuring the instruments were in sync and properly tuned was vital for a tight and polished sound. Any timing issues were corrected during the editing process.

- Panning: Panning involved distributing the sound of different instruments across the stereo field, creating a sense of space and dimension in the mix.

- High-Pass Filtering: High-pass filters were used to remove unwanted low frequencies from tracks, particularly on vocals and guitars, to reduce muddiness and improve clarity.

- Reverb and Delay: Reverb and delay effects were applied to add depth and space to the recordings, making them sound more natural and lively. These effects were used judiciously to avoid overpowering the mix.

Throughout the production, I focused on using these techniques to create a single that would replicate the sound and vibe of 1980s Finnish punk rock. The result was a high-quality recording that captured the raw energy and authenticity of the genre, despite being produced with affordable equipment in a DIY home studio. The techniques discussed can be applied to various recording projects, demonstrating that professional-grade results are achievable without expensive studio setups. The success of the "Luotuja Kulkemaan" single underscores the importance of creativity, technical knowledge, and a passion for music in overcoming budget constraints and achieving artistic success.

7 DISCUSSION

The example DIY techniques used in this thesis are basic producing, mixing, and mastering techniques. DIY music production in a budget or home studio environment involves managing the entire music production process yourself, often without the involvement of major record labels or professional studios. Despite the traditional association of recording studios with high costs and specialized equipment, advancements in technology have made it increasingly feasible for DIY musicians to create professional-quality recordings within a studio setting.

DIY producers handle all aspects of the recording process themselves, including setting up microphones, capturing performances, and managing recording sessions. They may experiment with different microphone placements and recording techniques to achieve the desired sound. DIY producers employ various production techniques to enhance the sound quality of recordings. This may involve editing and comping recorded tracks, applying effects such as EQ, compression, and reverb, and mixing the individual tracks to create a balanced and cohesive final mix.

While professional mastering engineers typically handle the final stage of music production in professional studios, DIY producers may opt to master their tracks themselves using mastering software or online mastering services. This involves refining the overall sound of the mix, ensuring consistency across tracks, and preparing the music for distribution. These producers often work with limited budgets, so they must prioritize spending on essential equipment and services. They may opt for affordable recording gear, open-source recording software, and DIY solutions for acoustics and soundproofing.

DIY producers frequently collaborate with peers and seek feedback from online communities and forums. They may share knowledge, exchange tips and techniques, and collaborate on projects to enhance their skills and creativity. This kind of music production in a DIY recording studio environment empowers independent artists to take control of their creative process and produce high-

quality music on their own terms, without relying on traditional industry structures. While it requires dedication, resourcefulness, and a willingness to learn, DIY music production offers a rewarding avenue for artistic expression and self-discovery.

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APPENDICES

Appendix 1. Euroopan Valot – Luotuja Kulkemaan
https://on.soundcloud.com/PYFHANJDg7FybhFYA