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Master's Thesis

Analog techno

The use of analog media within the techno scene in digital times

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Eidesstaatliche Erklärung

Hiermit erkläre ich, dass ich die vorliegende Arbeit selbstständig und eigenhändig sowie ohne unerlaubte fremde Hilfe und ausschließlich unter Verwendung der aufgeführten Quellen und Hilfsmittel angefertigt habe.

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Zusammenfassung

In Zeiten der Digitalisierung hat es für Aufsehen gesorgt, dass das tod-geglaubte Musikmedium Vinyl ein Comeback erfährt. Zeitgleich wurde ebenfalls der Markt für analoge Synthesizer wiederbelebt, so dass seit Mitte der 2000er zahlreiche neue Hersteller mit neuen Produkten in den Markt drängen. Dadurch können wir heute auf eine nie dagewesene Auswahl an analogen Synthesizern zurückgreifen. Die zeitliche Parallelität der Entwicklungen lässt vermuten, dass dies keine singulären Ereignisse sind und es einen Zusammenhang zwischen diesen „Revivals" existieren könnte. Eine Parallelität ist bereits gegeben, wenn diese Phänomene im Rahmen der Technoszene betrachtet werden, da diese analogen Medien nicht nur stilgebend an der Entstehung des Genres (und verwandter Stile) beteiligt waren sondern bis heute fester Bestandteil dieser (Sub)Kultur sind. Daher werden die analogen Medien Vinyl und Synthesizer für diese Thesis im Rahmen der Technoszene näher untersucht.

Dabei soll herausgefunden werden wie und warum analoge Medien Verwendung finden. Dies wurde bewerkstelligt mit Hilfe einer Nutzerbefragung von DJs und Produzenten die sich als Teil der Szene verstehen. Dabei wurden jene nach ihren Nutzungspräferenzen sowie ihrer Haltung zu verschiedenen Aussagen befragt. Dies ermöglichte ebenfalls, die Vorstellung des Begriffs *analog* im Produktionskontext zu erforschen, da jener nicht klar definierbar und verschiedenen Komponentenzusammenstellungen abhängig ist.

Dies setze voraus, mögliche Erklärungsansätze aus verschiedenen Forschungsrichtungen für die Nutzung analoger Medien zusammen zu tragen um Hypothesen aufzustellen, die es zu überprüfen galt. Die Ergebnisse der Befragung wurden verwendet um verschiedene Regressionsmodelle zu entwerfen und auszuwerten. Mit Hilfe von Nutzergruppen, basierend auf der individuellen Erfahrung, konnten diese Modelle für einige Hypothesen verfeinert werden.

Dadurch war es möglich zu erkennen, dass verschiedene Nutzungsmuster existieren und diese von bestimmten Motivationen und Haltungen beeinflusst sind. Neben einigen gruppenspezifischen Erkenntnissen, abhängig von Medium oder Performance-Situation, wurde festgestellt, dass es vor allem zwei sehr starke übergreifende Faktoren gibt. Zum einen schätzen Nutzer*Innen anscheinend, mit Objekten physisch zu interagieren. Zum anderen treibt das Verlangen nach den Möglichkeiten digitaler Alternativen die Nutzung digitaler Medien voran, was jedoch auch bedeutet, dass jene anscheinend nicht so wichtig sind, für die, die mit den Limitierungen analoger Medien zufrieden sind. Desweiten wurde festgestellt, dass drei möglich Definitionen für den Begriff *analoger Synthesizer* auszumachen sind, welche Rückschlüsse auf die damit verbunden Nutzergruppen zulassen.

Abstract

In times of digitalization, it has caused some sensation that the music medium vinyl, which was thought to be dead, is making a comeback. At the same time, the market for analog synthesizers was also revived, so that since the mid-2000s numerous new manufacturers have entered the market with new products. As a result, today we have access to an unprecedented selection of analog synthesizers. The temporal parallelism of the developments suggests that these are not singular events and that there could be a connection between these "revivals". A parallelism is already given when these phenomena are considered in the context of the Techno Scene, since these analog media not only played an aesthetic role in the emergence of the genre (and related styles) but are also an integral part of this (sub)culture to this day. Therefore, the analog media vinyl and synthesizer are examined more closely for this thesis in the context of the techno scene.

The aim is to find out how and why analog media are used. This was accomplished with the help of a user survey of DJs and producers who identify themselves as part of the scene. They were asked about their usage preferences as well as their attitude towards different statements. This also made it possible to explore the notion of the term *analog* in the context of music production, as it is not clearly definable and depends on different combinations of components.

This required to gather possible explanations from different research disciplines for the use of analog media in order to create hypotheses to be tested. The results of the survey were used to design and evaluate different regression models. With the help of user groups, based on individual experience, these models could be refined for some hypotheses.

This made it possible to see that different usage patterns exist and that these are influenced by certain motivations and attitudes. Besides some group-specific findings, depending on medium or performance situation, it was found that there are two very strong overarching factors in particular. First, users seem to value physically interacting with objects. Second, the desire for the possibilities of digital alternatives drives the use of digital media, but this also means that those do not seem to be as important to those who are satisfied with the limitations of analog media. Furthermore, it was found that three possible definitions for the term *analog synthesizer* can be identified, which allow conclusions to be drawn about the user groups associated with it.

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List of Abbreviations

ADSR	Attack, Decay, Sustain, Release
ARP	Arpeggiator
BPM	Beats per minute
CD	Compact Disc
DAW	Digital Audio Workstation
DCO	Digitally Controlled Oscillator
DIY	Do-It-Yourself
DJ	Disc Jockey
DMM	Direct Metal Mastering
EBM	Electronic Body Music
EDM	Electronic Dance Music
EP	Extended Play
LFO	Low Frequency Oscillator
LP	Long Play
NASA	National Aeronautics and Space Administration
PC	Personal Computer
PCM Sample	Pulse-code modulation Sample
RIAA	Recording Industry Association of America
RPM	Rounds per minute
UK	United Kingdom
UR	Underground Resistance
USA	United States of America
VCA	Voltage Controlled Amplifier
VCF	Voltage Controlled Filter
VCO	Voltage Controlled Oscillator
VST	Virtual Studio Technology

'I remember having to make that decision, you know, was it gonna be a car
or was it gonna be a Minimoog?

... I still don't drive' (Hans Zimmer, Moog Music Inc 2015)

1 Introduction

In times of the so-called digital revolution, new technologies and standards arise while rendering former ones obsolete. Thus it is no surprise that the rebirth of older standards causes excitement among various scientific areas as happened with the revival of the vinyl record as a medium for storing music. Being the main medium for commercial distribution of music from the 1950s for around 4 decades, many believed vinyl was gone after the invention of cassettes and CDs (Bartmanski and Woodward 2018, p. 5). While the CD is in decline after the introduction of digital file formats like MP3 and streaming services with the rise of the internet, vinyl sales started to rise again rapidly beginning in the mid-2000s (RIAA 2018). Around the same time we can observe a similar development in the market of synthesizers, so this phenomenon doesn't seem to be exclusive to the medium of vinyl but is also observable in the area of music production. While digital technologies took over in the mid-1980s and pushed analog synthesizers to their extinction we see a rise of product releases beginning with the Moog Voyager by Moog in 2002 or the Prophet 08 from Dave Smith Instruments in 2007. Since then, every year more and more so-called analog synthesizers are being thrown onto the market by a rising number of vendors. Today customers face a variety of products unseen before and at the same time being more affordable than ever (Holmes 2013).

While both, vinyl and analog synthesizers seem to be dead on the surface they were always present in certain music scenes, specifically within the electronic dance music genres of House and Techno. During the 1980s, discontinued products such as the TB-303, TR-808 or TR-909 by the Japanese Cooperation Roland were affordable for young music producers as their mass production was not successful on the commercial market and thus being available for little money on the second hand market. This availability allowed using them in order to shape the aesthetics of new genres like Techno or Acid House (Collins et al. 2013, p. 106). Ironically these products became so popular in this

scene that their prices on the second hand market are in the thousands nowadays. As the demands are high companies like Behringer, xOxBox or Acidlabs started to produce clones and replicas again.

Because the history and development of media can be linked to specific music genres and their subcultural scenes I will focus on a specific one, being the *Techno Scene*, as the scope of this thesis would be too broad and a topic itself to research different scenes, their values, how they interact and differentiate from each other. Vinyl as a medium for DJs also faces competition from digital file formats which forever seem to encroach upon and consume them. For both types of media the digital alternatives seem to outplay their analog counterparts in various categories, yet both are still being used today.

Why this is the case will be a central question being answered in my thesis. This will allow to draw parallels and to find out about the similarities and differences between these media, which seem to share not only their history but also many common properties. This is of particular interest as the revival of vinyl was covered by a lot of literature and public interest which is not true for synthesizers where is only very little research available. Comparing these two might reveal insights which can be transferred from one medium to other while at the same showing specifics of a certain user group or scene.

To achieve this it is necessary to take a look at the history of analog media in general and afterwards at the specifics of vinyl and synthesizers. These need to be analyzed in terms of their history, current situation and technical properties in order to show where and how these can be compared. Framing this in the context of the *Techno scene* will narrow down a potential target group to be researched while at the same time extend the perspective to social influences due the existence of subcultural scenes and their norms and values. From there on the use of analog media can be examined from several angles with the help of theories and literature from different disciplines such as social sciences, media theory or technical analysis. A challenge will be how these can be brought together in order to form a cohesive and comparable set of hypotheses and research questions.

These will be answered with a help of a survey among users of the Techno scene. They will be asked how and why they use which kind of media. With the help of producers it will also be possible to understand what *analog* means in terms of synthesizers as this is actually not really defined and can be interpreted in different way (or at least manufactures are stretching that term in order to market their products) which might also reveal different target and user groups.

As a result it will be shown how the usage of analog media for DJs and producers compares and how it differs in home and stage environments. The subjects will be reached using a non-probability sampling method so it can be assumed that the sample will reflect the German and Berlin scene primarily.

2. Current state

2.1 The analog medium

A medium (origin: latin *medius*: middle) can occur in different forms, with different functions and has severe impact how humans interact with each other or the world around them. In order to grasp these different aspects the discipline of media science was created and acts as a link between engineering sciences and humanities. One of their most prominent representatives was the American Marshall McLuhan and his famous claim: '*the medium is the message*' (McLuhan 1971, p. 1). This hints at the tasks which media theory has to fulfill and is trying to teach: the medium and its properties shape our perception of the content which different media are carrying. Moreover, they extend not only their meaning but also the humans and their perception of the world (McLuhan 1971, p. 21). This creates the challenge to analyze media from different perspectives as

> there is no medium that can easily be isolated as a function and reduced to the technical issue of its *'format'* whereby this or that sound carrier is turned into pure scientific case. Even seemingly *'immaterial'* virtual files imply specific practices and engagement with physical devices. (Bartmanski and Woodward 2015, p. 53).

While for some authors there is a natural close proximity to Marxist theory of a medium, due to his ideas of *materialism* and his theory of *productions means* (Baudrillard and Metzger 1978), others focus on the specific impact of the development of certain forms of media and their notion of their *aura* (Benjamin and Lindner 2011). For this work especially the differences between analog and digital music media are of specific interest. Music media are specified as an aesthetic communication form and hence integral part of cultural human life (Barth 2013, p. 12). Therefore, McLuhan's claim is often considered to be too one-dimensional and is being expanded by different concepts. For example, all media could be separated into four different groups: primary media are all verbal or non-verbal signals which are being created by the human body. Secondary media are being created with the help of technology (for example prints) while tertiary media also require technology in order to be received (like radio). Additionally, all digital media could be considered as quaternary media (Barth 2013, p. 15). This helps to distinguish between different properties and their influences but also connects to one important factor: technology, which will be a decisive characteristic when differentiating between analog and digital media.

One way to distinguish between those terms would be the perspective of a signal. An analog (in British english also *analogue*) signal can always be represented as a *continuous* mathematical function, meaning it has an indefinitely fine resolution for the measured dimension (for example time and sound pressure). A digital signal is always *discrete* in a way that all measured dimensions have

fixed values which cannot be further be extended, once measured (Weinzierl 2008, p. 12). Hence, all information which is stored and processed in computers is always discrete.
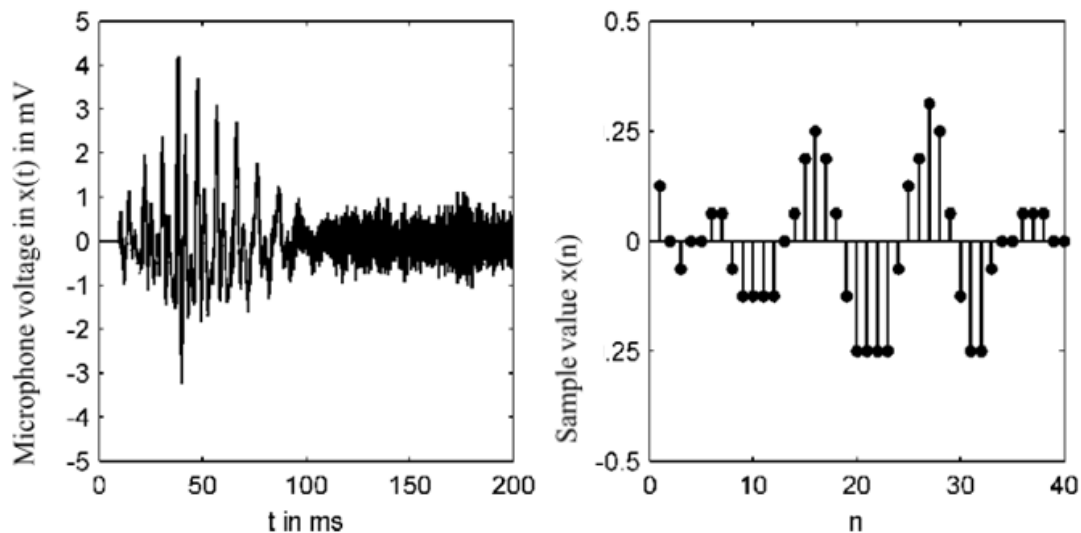
Figure 1: Continuous signal (left) and discrete signal (right) (Weinzierl 2008)

Another distinction which is sometimes made is thinking of analog media as material and digital as immaterial. This is not correct, especially from a signal perspective. The CD is for example also a digital medium in the way it stores music (or other data) in bits. However, the distinction between immaterial *files* and material *objects* will be of high relevance for this work. Physical devices are tactile in a way that humans can interact with them but also possess and collect them which makes them a representation of ourselves and part of our identity (Belk 1988, p. 145). This also means that they are bound to physical laws which in return shape the properties of the objects and the way we can interact with them.

Immaterial media are relatively new within the history of mankind as they only occurred since the invention of computers. Although they are not completely immaterial as they also are bound to physical limitations as they need space on storage media, there are numerous significant differences when compared to objects. With the increase in computing power, the development of the World Wide Web and the ongoing globalization, digital media has excelled many physical and social boundaries and changed not only the way humans consume media but also how they interact, communicate and create economic values.

This is specifically portrayed with music media. The concept of *media-morphosis* describes that the content of the medium is changed by the development of the medium itself (Barth 2013, p. 14) and

electronic music is a perfect example of this. Electronic music instruments introduced new sonic timbres, other ways of composing and performance (e.g. with the help of sequencers) and created completely new genres this way. At the same time, new ways to record and play back music allowed for the emergence of a DJ culture or a complete change on how we integrate music into our daily lives (with the help of streaming). Furthermore, the digitalization offered new tools to produce and distribute music which in return allowed short circles of innovation and a development of a multitude of new styles and genres.

Recorded music also allows for the distinction between the medium which stores the music and the devices required for playback. Physical mediums like vinyl are usually bound to a specific device like the turntable. The same applies to cassettes, tapes or CDs. While immaterial files also require some kind of computer for encoding this can appear in different shapes like PCs or stand-alone devices like CDJs (see chapter 2.2.1) which enable different ways of interacting with the recorded music.

2.2 Vinyl as a performance tool for DJs

2.2.1 History and current situation

When in the 15th century Johannes Gutenberg introduced a new way of printing and manufacturing books, he started a revolution. It was the beginning of the Renaissance and he would later be recognized as one of the most important inventors of the last 1000 years (Huber and Müller 1993). The possibility to share and store knowledge other than with spoken word made the written word in medium of a book a driver of social change. It forever changed the development of our civilization. This made it also possible to store and distribute music in form of written scores and thus also laid for the foundation for the development of western classical music.

Although a similarly grandiose impact didn't happen with the invention of the storage of sound it can still be observed that the medium exceled its function of only storing information. Beginning with the Phonograph by Thomas Edison from 1877 it took some iterations from the Graphophone to the Grammophon which was later already working with shellac-records and with the same concept as contemporary records (Osborne 2012, p. 17). While shellac-records faced some limitations in regards to durability, playtime and audio quality due its soft material the invention of the vinyl record was a huge step forward. The new material allowed more play time with fewer rounds per minute while providing a wider frequency spectrum and being less vulnerable to abrasion which in return allowed the record to be played more often. Since 1957 it was possible to cut two channels in vinyl which made it a stereophonic medium allowing for listening to music in unprecedentedly high quality. This

enabled the rise of pop and rock'n'roll music and the emerging music record industry quickly made it the main medium of storing and selling music (Bartmanski and Woodward 2015, p. 29).

Although the initial attempts to mix several records together happened by the likes of Paul Hindemith and John Cage in the 1930s (Osborne 2012, p. 35), it took until the invention of the disco genre in the 1970s to morph vinyl into a performance tool. This genre was built upon a culture of going to a dance-club in which a DJ would mix two records into each other (Kühn 2017, p. 70). To support this the EP-format was created on which only a few tracks with a total playtime of 5-15 minutes would be cut onto a single site (in comparison to up to 30 minutes on a regular LP) which allowed the tracks to being cut on much higher volume (Osborne 2012, p. 244) .Also, so-called 'disco-edits' were created which enhanced the tracks with a longer beat-focused intro and outro with low harmonic content which would then enable the DJ to mix the previous into the next track. This was accompanied by the Turntables Technics SL-1200/1210 MK2 by the company Panasonic as the main tool being used for more than 40 years.

Digital alternatives were developed but not until the 2010s did these tools really become industry standards and an alternative in the DJ Booth. At first there were computer programs like Native Instruments' Traktor or Serato by Serato DJ. Both required to set up a computer on the stage, often together with a controller to control the software and connected with changing the cables and routings of the booth while doing so. They even introduced the link to turntables with so-called DVS (digital vinyl system) which basically turned the record player into a controller as they used special records which send a signal to an audio interface which decodes it and would then control the software. This way DJs would have the same feeling of vinyl but could still make use of the advantages of the software. Although those solutions are still being used today the real game changer was the introduction of another device: the CDJ. This product by the company Pioneer started as a CD-player back in the 1990s and soon tried to include DJ-Features such as pitch control. Soon they took over ideas from the computer programs like looping, cue points, automatic beat synchronization, playlists or preparation of gigs with their own software *rekordbox* (Rothlein 2013b). As they support different audio formats which allows DJs to play files they get very cheap or even for free it enabled these devices to finally take over as an industry standard in the club in the 2010s. It is remarkable that this took so long as this development was already happening within the consumer market some 30 prior.

The invention of the CD as a digital medium already pushed the vinyl record to near extinction. It seems to be a coincidence that it falls into the same period as the invention of techno (see chapter 2.4.1) as the CD was introduced in 1982. It could also be seen that the reference of the term *Techno* to *Technology* was hinting at the Zeitgeist at that time which was pushed by inventions like the personal computers or the CD. Ironically it seems that the Techno culture which identified itself as being technology-driven, forward-looking and boundary-pushing seemed to be quite conservative in regards to the preferred medium of choice. This was due to the attribution to the medium vinyl as being superior medium and the reasons for that can be found in chapter 2.2.2. This didn't played much of a

role in the consumer world as the CD offered various advantages such as a higher dynamic range (actually for the first time it was made possible to have a dynamic range higher than the music required), more linear frequency response, especially in the high frequencies (which was often described as being 'clean'), while taking much less space to store and being able to listen to music up to 80minutes without a break (while vinyl requires one to turn the record every few minutes) (Bartmanski and Woodward 2015, p. 34). From an economic perspective the CD also offered huge potential as it was way cheaper to produce (with a similar retail price) and offered labels to re-release their back stock for the second or third (after the cassette) time (Bartmanski and Woodward 2018, p. 2). That's why the medium was also advertised as superior medium:

Figure 2: Advertisement for Sony's first CD Player in 1982 (Guttenberg 2012)

The vinyl industry reacted immediately and invented the Direct Metal Mastering (DMM) process which cuts directly into a metal plate instead of a lacquer. This allows for a much better frequency response in high frequencies at a cost of a loss of low frequency energy as this would require much more energy to be cut into metal (Bartmanski and Woodward 2015, p. 35). All of this didn't help and in the US the CD surpassed the vinyl sales already in 1987. As there is mostly only data about the US market available to the public it will be used as reference in this work:
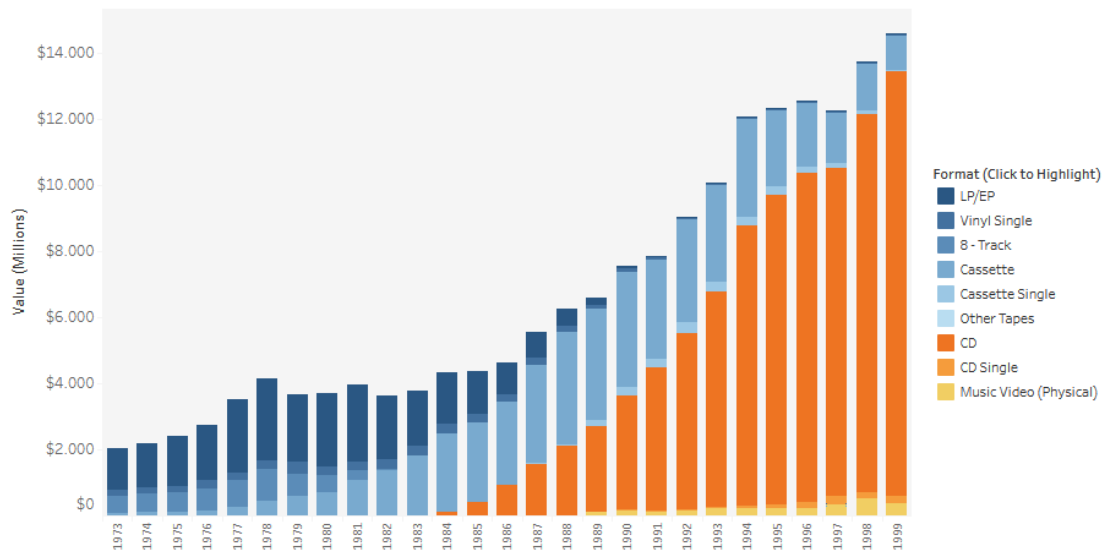
Figure 3: Music revenue per format in the U.S. between 1973 and 1999

in 1987 LP/EP revenue was €793.1m vs CD €1.6b (RIAA 2018)

The CD not only surpassed vinyl but also the cassette which itself already surpassing the vinyl record by 1985 (in the UK) and was introduced as a small and portable format. Although it never came close to the audio quality of the vinyl (Osborne 2012, p. 47). The fate of the vinyl record also happened to the CD: technological progress made it lose its position as a market leader. The next digital revolution in shape of the internet introduced digital downloads and streaming leading to a current market share of 62,1 % (International Federation of the Phonographic Industry 2021). It is expected that this downfall will continue. While this happened, vinyl was kept alive mainly by passionate vinyl collectors, music enthusiasts and DJs. During the middle of the downfall of CDs, vinyl sales started to rise again. The so-called Vinyl-revival started '*Between 2008 and 2012, and only according to the mainstream Nielsen SoundScan data, over 15 million analog records were sold internationally, which amounted to more than the entire sales between 1993 and 2007'.* (Bartmanski and Woodward 2015, p. 43). In the end of 2020 vinyl sales outperformed CD again with the highest recorded sales per week since 1991 (Caulfield 2020). While all this sounds positive for the vinyl market this situation has led to severe problems: as there were only a few pressing plants available they couldn't handle the increasing demand which led to longer handling times, an increase of costs and the fact that bigger labels with bigger orders are actually privileged over the small indie labels which kept the market alive for so many years (Mantione 2017). Additionally, all the factories and pressing plants run on old machines as the market was for a long time not profitable enough to justify the big investments needed in order to develop and create new machines. This makes it more difficult and expensive to maintain the older one over time. Also a new technology in creating the masters is currently in development: HD-vinyl. It

is promised to deliver more playtime, higher volume and lower costs. The project is still in development so it is still unclear if these requirements will be met.

On February 6th 2020 a fire burned down one of the two remaining factories in the world which produced the lacquer disks which are needed in order to produce the master discs for pressing. This is even more significant as this was by far the biggest supplier of the market. It is still too early to see what the long term consequences might be but it can be assumed that the prices for the lacquers will rise sharply as the supply drops significantly and as on the other side this situation results in a monopoly by the last remaining supplier MDC from Japan which in return usually results in further price increases (Blistein 2020). It is likely that especially small indie and techno labels might not be able anymore to pay higher fix costs as they already operated on the edge of breakeven which can be seen in the tables Appendix A. Against the overall market situation it seem like the growth did not happen in this scene. (Gomez 2017, p. 29) In fact, it seems like they suffered from the hype as costs increased and demand further decreased which leads to the situation that a lot of smaller label produce only 300 or even 200 records which is hardly enough to cover the costs. (Bartmanski and Woodward 2015, p. 168)

2.2.2 Description of properties and characteristics

The concept of the vinyl record hasn't changed much over the years as innovations mostly happened in the digital domain but also because vinyl was seen as an already superior medium. To understand why it is important to show briefly how a vinyl record is made and what properties result in the course of this process. The start of the vinyl production is the so-called lacquer master disc (this is why the destruction of the factory which produces them is such a big deal for the industry) or with a metal plate of copper in the case of DMM. The choice of the used format already has implications on the sound and it is usually decided by the mastering engineer or the pressing plant. The lacquer has a soft material and the stylus which is used to cut the groove heats up very fast which is why a high frequency cut needs to be applied beforehand in order to prevent the stylus from overheating. Additionally due to the soft material, high frequencies tend to be less precise (Bartmanski and Woodward 2015, p. 91). This is why the CD was perceived for having a clear and pristine sound which resulted in the invention of vinyl DMM, to remain competitive with CDs. In this case the music is directly cut into a metal plate which results in a better high-frequency resolution. This results in a loss of low frequency energy as it would simply require too much energy to transfer those frequencies on a high volume which makes the whole process not very suitable for electronic dance music (with its focus on low frequency content). No matter which process is being used, the music is directly being cut in a two dimensional format. While the horizontal axis contains the sum of both channels, the Y-Axis stores the differences between the left and the right channel (Bartmanski and Woodward 2015,

p. 89). There was also the invention of a quadraphonic record in the1970s which would basically cut two grooves simultaneously (thus would also require two systems for playback) but it was never a big success. The two dimensions results in another requirement: the lower the frequency, the more the two channels most correlate which tends to towards a complete monophonic bass which is actually useful for electronic music as most subwoofers in club sound systems only playback mono anyway.
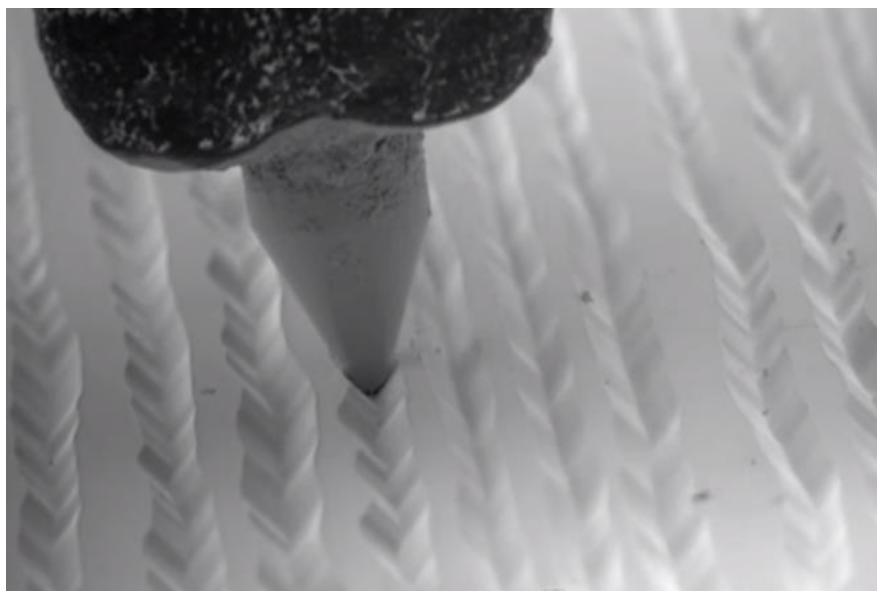
Figure 4: Needle of the stylus recorded under an electron microscope (Fact Magazine 2015)

Once being cut those master discs progress to the electro-plating (also known as galvanic). This chemical process will create negatives and result in master stamps which then are being used for pressing the final record. It is important that this process happens in an ultra-clean or high purity environment because any dust and dirt particles which lay down on the stamps would be duplicated to every record. When done these stamps are set into a pressing machine and warm PVC (i.e. Polyvinyl Chloride and thus the format's term *vinyl*) pellets are being pressed together so the result is an optimal nearly perfect reproduction of the initially cut master disc.

Before production starts several decisions need to be made which also result in sound implications: the format (7,10 or 12 inch) which mostly depends on the overall playtime and more importantly the playback speed (33 or 45 rpm [78 rpm was used on shellac]). The playtime in combination with the form factor is the result of the maximum volume that can be cut. More volume results in higher amplitude which takes up more space on the discs which in return lowers the playtime. The playback speed is also depended on the form factor and volume but also results in the high frequency resolution especially the longer the records plays (Bartmanski and Woodward 2015, p. 87). As the playback stylus is usually moving from the outside to the inside (other way is also possible but rarely seen) it covers less track per second while moving inside which results in a loss of high frequency content

(Osborne 2012, p. 47). In summary one could say the optimal format for dance music would be 12 inch record of a maximum playtime of 7 minutes per side which allows the tracks to be cut in 45rpm in a high volume.

Not only the cutting process determines important sonic characteristics but also the playback. In order to amplify a continuous signal on the record the playback stylus moves on the groove and the movement is connected to magnets inside the cartridge which induces a low voltage signal. This signal is sent to a phono pre-amp where the RIAA-curve is applied to amplify the signal to a normal audio range. This RIAA-curve was already applied when the record was cut in order to gain more playback time, improve sound quality and reduce groove damage during playback. It was introduced in 1954 by RIAA. It reduces the amplitude of low frequencies while pushing the high frequencies which gives more space on the records. For the playback this frequency curve is being reversed but the sonic implications are that imperfections can be attenuated such as low frequency rumble (from the turntable).
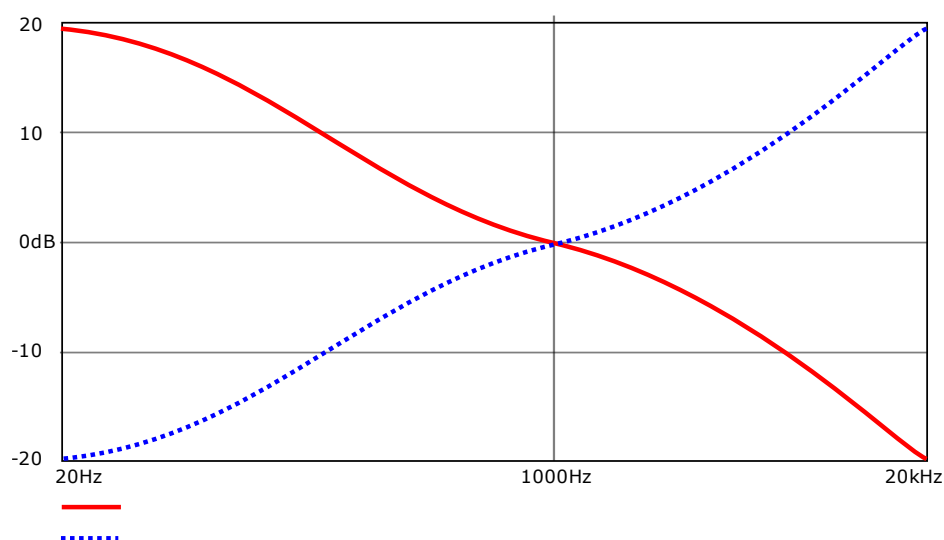
Figure 5: RIAA equalization curve (LedgerNote 2019)
Lower frequencies are being reduced in the cutting processed and amplified during in the phono amplification stage. High frequencies are being handled the opposite way

The vinyl record is not only storing sound but also functions as a material object. The need to interact with this medium in order to use it also provides meaning to the other material properties. One of them is being a carrier of graphic content. Except for white label releases every record come with a outer sleeve which can show pictures, designs, information about the record (Artist, Label, Tracks, Barcodes etc) and is also part of the visual communication between label and consumer. The record itself is

usually black but it can basically be in every color and shape. It is even possible to print a picture onto the disc (so-called picture disc).

Figure 6: Picture and shape disc: Exodus by The Exaltics feat. Egyptian Lover on SolarOneMusic (Bandcamp 2019)

Usually there is another label on the records itself which can again provide information about the record or hold small graphic content. These might be important factors when measuring an object's value and making it attractive to collectors (more on the in <u>chapter 2.5.3.3</u>) Being a physical medium the record also interacts with its physical surrounding which makes the record vulnerable to external influences, one being the risk of deformation when exposed to heat. On the other side the small grooves easily accumulate dust and dirt which lay down from the air or are being dragged from the stylus over the record. As the stylus is in direct contact with the record itself material abrasion is inevitable which will further decrease the playback quality over time. Those imperfections are an important part of the overall listening experience and somehow contribute to the sonic qualities of the medium. Apart from abrasion a vinyl record it also vulnerable to other physical deformations caused by scratches, a common and often lamented downside.

However, it's a constituent storage medium: it is persistent meaning it can hold the information stored on it basically forever when protected. The way the audio is stored in its pure form doesn't requires any kind of decryption and is not bound to a specific technology, another critical reason why this format was used for the *Voyager Golden Record:* a record that NASA sent out into space with the

Voyager I & II satellites with the intent to share some basic information about our planet and the human species. So far, it seems that vinyl is one the very few mediums that is nearly eternally persistent. In that regard alone, it's superior to digital mediums.

All of this indicates that the term vinyl is not very precise as it is only the term for the material being used. While there are also terms such as 'record' or 'disc' they all refer to specific qualities of the object (Osborne 2012, p. 12). Therefore even if the term vinyl or vinyl record in mentioned in this work, it always embodies all aforementioned characteristics groove, shape and artwork.

2.3 Analog synthesizers as instruments, production and performance tools

2.3.1 History and current situation

Music is one of the oldest human cultural techniques. It was not only the development of communication (e.g. music) but also the ability to craft and use tools which resulted in the rapid development of the human race on earth. The tools became more sophisticated and music evolved into a complex set of rules that was paralleled by new instruments and the possibilities they gave humans to express themselves. Within the last 400 years we found a more or less static set of instruments within western music such as those used in classical music. Composers chose and used them based on basic preferences like pitch range, sound characteristics and possibilities to play. As they were made out of natural or processed material like wood, metal or skin they were also bound to limits in regards of timbre or playability. This changed with the discovery on how to make use of magnetic and electrical forces that resulted in the electrification of humans and another huge step in their development. One of the inventions based on electrical power was the loudspeaker which transforms an electrical signal to an acoustic one. This electrical signal could either be a recorded one (through a microphone) but could also come from a machine which itself creates an audible spectrum for the human ear. This resulted into inventions like the Telharmonium (1917), Theremin (1919), Ondes Martenot (1928) and Trautorium (1930) which can be considered as the first electronic instruments (Philharmonie de Paris 2021). The second one, the Theremin, was later built and sold by a young student called Robert Moog who founded the Company R.A. Moog Co., which would later become Moog Music Inc.; he went on to create one of the most, if not *the* most important instrument for the history of electronic music: the Minimoog. Before that the concept of a synthesizer was already established by the very same Company of Robert Moog and his father or by Don Buchla and his company Buchla Electronic Musical Instruments (Lee 2018). Both started with so-called modular synthesizers which despite having different input methods for music notes (a classical keyboard on a moog and a touchplate for the Buchla) shared a similar idea of generating sound: voltage controlled oscillators (VCO) and/or noise created a spectrum of sound that was afterwards filtered (VCF / voltage

controlled filter) and then amplified (VCA / voltage controlled amplifier) which could then be played back by loudspeakers or headphones. This signal path could be modulated by envelopes or low frequency oscillators (LFO). The elements or modules must be connected via wires to change the flow of the signal and introduce other ways to control or interfere with this like sequencers or ring modulators. All combined it describes where the term *synthesizer* came from as the user had design an artificial audio signal or in other words: synthesized a sound.

This required a knowledgeable user who understood both, the musical and electrical signal path aside from the need for space and money. Therefore it was only accessible to a few privileged musicians.

Figure 7: Wendy Carlos playing an early moog modular.
With Switched-On Bach she created on of the most influential pieces of early electronic music (Moog Music Inc 2021)

This changed with the invention of the Minimoog in 1971. Not only was it delivered in a much smaller form factor and was much more affordable (US$1,595 retail price compared to $7,985 for a Moog Modular), but the modules were also hardwired and it featured a 44-note keyboard so it was much easier to use by classical trained musicians. All this made it the first commercially and widely accepted synthesizer. The same path was also taken by the company ARP Instruments Inc. with their ARP 2600 (1971) as successor of the ARP 2500. The Japanese Company Roland Corporation released their SH-1000 in 1973 and after working on a semi modular System 100 or modular System 700 they would release a series of machines which had a huge impact and became very popular. Amongst them were the x0x series (303,808,909, see chapter 2.4.3) the Juno (6,60, 106) and Jupiter (8,6,4) series. They would all shape the sound of the 80s and beyond. During that time another revolution had already begun. While some companies like Sequential Circuits already released

synthesizers with digital parts to make it programmable (Prophet-5) it was the Bell Labs Digital Synthesizer that was the first fully digital additive synthesizer and was developed during the 1970s. What made it unique was not its additive approach (which was basically already used with the Telharmonion) but the fully digital design. Shortly later the sample based Synclavier and Fairlight CMI had a bigger success but they all shared the same short comings: similar to their counter parts in the analog world these first approaches were expensive, a chunky piece of equipment and hard to use. The Japanese Company Yamaha which licensed the algorithms for FM-Synthesis from pioneer John Chowning created a product which would start the downfall of the analog world: the Yamaha DX7 was a 7-operator FM-Synthesizer with a reduced user interface, was used mainly with presets and became one of the most commercial successful hardware synthesizers ever build (Philharmonie de Paris 2021). Other manufacturers followed this path (Korg created the M1 and Roland the D-50) so over the course of the 1980s and 1990s there were not that many innovations happening in the analog world. Still the term lived on and was used for new concepts for so-called virtual analog synthesizers like the Access Virus Ti or the Nord Lead.

By the 90s the digital revolution gained pace and as it influenced all parts of society it also changed the way music was created. Due to this, completely new concepts such as DAWs or VSTs evolved and pushed the production process into new areas as described in <u>chapter 2.5.2</u>. Although there have been analog synthesizers around from companies like Novation, Waldorf, MFB, JoMoX or Doepfner (which created the Eurorack format) it took around the middle 2000s until a new age of analog innovations took place. And again it was the company Moog Inc. which kicked of a series of new products (Boothroyd 2013). After the brand rights of Moog music have been re-acquired, the Minimoog Voyager was released in 2002. It was basically an updated version of the classic model D version with added digital controls for patch storage and further modulation options (Jenkins 2007, p. 217). Although this was not the first product which such a feature set it was a concept which would soon would became standard among a huge wave of new products. Dave Smith Instruments (a successor of sequential circuits which nowadays operates under their old name again) released the Prophet-8 in 2005 and new companies entered the market like Arturia or Elektron. Most recently the company Behringer caused a lot of discussion within the producer community (MusicTech.net 2020) as they cloned many legendary synths like the Korg MS-20 (now sold as K-2), Prophet Pro-one (Pro-1), Minimoog Model D (Model D), ARP Odyssey (Odyssey) as well as the Roland SH101 (MS-1) & VP-330(Vocoder VC340), 303 (TD-3), 808 (RD-8) and 909 (RD-9).

But there are also new concepts. It can be observed that many major manufactures tried to combine analog and digital sound generation (like wavetables, granular synthesis or samples) while keeping an analog filter and amplification to offer a more flexible set of possibilities for sound design. Most of them are being considered as flagship synthesizers and come with a higher price tag, for example Novation Summit, Korg Prologue or Waldorf Quantum. No matter which architecture is chosen, is

seems like there is a variety of analog synthesizers available on the market unseen before. At the same time they are as affordable as never before which makes synthesizers one of the fastest growing markets in the music industry (Mok 2016). It is obvious that the term 'analog' is on vogue and it is used by the industry as a sales argument. This can be seen as this term is even used to sell digital technology as Rolands' Analog Circuit Behavior (ACB) which is simulating analog behavior. Other companies as the recently established Ashun Sound Machines use it for their marketing to target customer which are looking for analog hardware:

Figure 8: Advertisment of the ASM Hydrasynth introduced in late 2019 (Ashun Sound Machines)

Unfortunately there is no data available for the public regarding the development of the sales of synthesizers so it can only be assumed that the market is growing based on the fact that there is constant development of new instruments happening.

A separate scene evolved with the revival of modular synthesizers. Although they were the first real analog synthesizers they vanished away due to the development of desktop products like the Minimoog. During the 1996s they came back with the release of the A-100 system by the German manufacturer Doepfer Musikelektronik GmbH which set the Eurorack standard. This standard defined size, power infrastructure and signal levels which made it easy for third party developer to create modules themselves so a huge scene of DIY developers emerged and the market is still growing (Orkin 2017) . Due to this is not possible to think of a modular system as an analog synthesizer by default anymore as there are also multiple modules which in their core are completely digital and only the transfer of the CV/Gate signals analog so in the end it depends on the individual setup of the modules. Therefore modular systems will be ignored for the cause of this work.

2.3.2 Definition and technical properties

It was shown in the previous chapter how technology shaped the way new instruments were created. In order to understand which properties might be important for theirs users it is necessary to have a brief overview over the functions and the common setup. Analog synthesizers often follow the concept of subtractive synthesis as found on the Minimoog.

Figure 9: The classic minimoog model D

Oscillator Bank features VCO and LFO (switchable oscillator 3). The mixer blends these oscillators, noise and feedback together. VCF is found in the upper mid-right position (Filter). VCA is the loudness contour (ADS envelope) and output sect. (Silva 2019)

As the name suggests this concept is based around the idea to cut away parts of a given spectrum. This spectrum is generated in the VCO section where one or more oscillators generate sound based on a selected waveform, tone range (playing octave) and input given by a keyboard or a sequencer. This signal then enters the VCF stage where a filter 'cuts' away certain parts depending of the selected mode and the cut off frequency. The most common ones are either Low pass (similar to High Cut), High pass (Low cut), Band pass or notch (band reject) and the names determine which parts of the spectrum are passed through or cut away. Other characteristics of a VCF are the filter steepness

measured in dB (most common are 6db, 12dB or 24dB) and its resonant behavior which are very important to the sound modification. In most cases this filter is controlled by an ADSR envelope which controls the cut off frequency over time given by an input. An identical or same modulation is also applied on the last stage: VCA. Here the signal gets amplified into audible levels which is often controlled by the velocity of an input like a keyboard and then modulated over time by the envelope. Next to (ADSR) envelopes there is often one or more LFO (low frequency modulator) which is either hardwired to a parameter of on the 3 stages or can be freely assigned. This LFO usually has similar operating modes as a normal VCO meaning it has different waveforms to choose from and an operating range which is usually between 0.1 and 20 Hz which is not in the audible range which makes the change clearly perceptible. Some LFOs also offer ranges beyond 20 Hz to enable Frequency modulation (FM) which enhances the sonic possibilities of subtractive synthesis. Each of the stages contributes to the sound characteristic which can be dependent on the used components or/and the architecture (e.g. the moog ladder filter design) while modulation possibilities offer different options to alter the sound in various ways. While the components changed over time (example VCO to DCO) some architectural designs can be found up until today or as Dave Smith compares the new Prophets to the old one:

> *'The basic analog technology is virtually the same, we use Curtis filters that are the same design as those used in the Prophet-5. But surface-mount technology produces much smaller circuit boards, at a lower cost, with higher reliability, and with better electronic performance. Plus, to control the analog circuitry, we use microprocessors and DSP processors that are much faster and simply were not available back then.' (MMR Magazine)*

This also explains why today synthesizers are available at a much lower cost and provide more functionality which at the same time introduces the problem of the definition of an analog synthesizer. How many and which parts have to be analog in order to call an instrument an analog synthesizer? Which seems obvious at the first look unveils a problem as there are different configurations and obviously most manufacturer call their product analog only for marketing reasons. Looking at the current market there are separate categories based on sound generation, modulation and programming options as well as the interface design. A possible categorization could look like:

- Completely analog
    - Examples: Minimoog, Korg MSs20, ARP-2600 Odyssee
- Analog sound generation and analog Interface with digital features like Patch storage, arp, sequencer, USB Connection, Effects, Envelopes, LFOs
    - Examples: Junos, Arturia Microbrute, Moog Voyager
- Analog sound but digital interface: menus
    - Examples: DSI Prophet, Elektron Analog four, Korg Pro/Minologues
- Partly analog sound generation:
    - mostly digital OSCs, analog filter (e.g. novation peak, MeeBlip)

- mix between analog and digital synthesis (Waldorf quantum , Moog one, Novation Summit, MFB Dominium club, Korg prologue & Minilogue XD)
- Analog imitation: virtual analog:
  - Examples: Virus Acess TI, Roland ACB

All this illustrates that the market is currently vivid and diverse which makes it even harder to provide a clear definition on what *analog* today means. The choice of components not only defines the sonic possibilities but also the workflow and usability. This is also reflected in the huge price span of currently available synthesizers which can start around 100€ (Behringer TD-3) up to around 8000€ for a Moog one.

2.4 The techno scene as a global movement

2.4.1 The beginnings of electronic dance music

When in 1970 the German group Kraftwerk formed no one would have thought about the impact they will have on future generations and the birth of completely new musical genres. Not only were they using electronic instruments to create tones and harmonies, they also made use of sequencers which created a mechanical precision within music no human could ever recreate. Custom made vocoders and drum machines formed a new aesthetic which was also conveyed with the titles of their albums like *Autobahn*(1974), *Trans-Europa-Express*(1977) or *The Man-Machine* (German: *Die Mensch-Maschine*, 1978). While there was already electronic or electroacoustic music being made before from Composers like John Cage, Carl Heinz-Stockhausen or Iannis Xennakis, Kraftwerk focused on rhythmical elements and the use of effects to alter their voices. These techniques were picked up by the creators of *Italo Disco*. They used a similar set of tools and mixed it with disco music, which emerged as a dance oriented genre in the 1970s in the USA and UK. As the name suggests, Italo Disco had its origins in Italy but became quickly popular on the German market and spread over Europe. Disco music was also responsible for the invention of the vinyl maxi format which enabled Disc Jockeys (DJs) to mix two records and thus create a constant beat people can dance to without a break (see chapter 2.2.1). While Italo Disco was still influenced by the heavy focus on harmony, *Electronic Body Music* (EBM) used the mechanical, almost cold atmosphere some Kraftwerk pieces introduced and used it for creating a dance music which was much more focused around electronic beats on 4/4 beats and an often harsh and industrial sound characteristic. It emerged mainly in Belgium and had its origins in new-wave and synth-punk which were representing a more aggressive aesthetic within the music.

All these different developments contributed to the birth of Techno. The term describes a specific genre but is nowadays also used as a category for a collection of styles which share similar musical

concepts and maybe even more importantly a common history as sub culture. Techno is an undefined short form connected to the term technology. Sometimes also the term techno-futurism was referenced indicating that it is not just a technical reference .Jeff Mills described it as Techno '… *wasn't designed to be dance music, it was designed to be a futurist statement..*' (Gieben 2013)

Although as with many music genres it is hard to define a clear starting point it is clear that one of the first major hubs for techno was Detroit. The American city, also known as *Motor City* or *motown*, faced a recession in the second half of the 20th century. Poverty and crime raised and together with a cultural heritage in music with the important soul label *Motown-records* it became a birthplace for techno as specific genre (Kühn 2017, p. 124). It was in the rural area of Belleville where Juan Atkin, Derrick May and Kevin Saunderson met and who were later known as *The Belleville Three* because they are widely recognized as the founders of techno. Together with Rick Davis, Atkins was already producing and releasing music under the alias Cybotron in 1981 on the label Deep Space Records. As *Model 500* Atking released '*No UFO's*' in 1985 on his label *Metroplex*. Depending on the point of view somewhere between those two projects the starting point for techno can be found. Derrick May followed with his label *Transmat* 1986 (it's catalog code MS stands for Metroplex Subsidiary) and Kevin Saunderson started his own label *KMS* (short for his initials Kevin Maurice Saunderson) in 1987. The latter one formed the group *Inner City* in 1988 together with the singer Paris Grey and produced the Tracks *Big Fun* and *Good Life* which basically brought Techno and House music to Europe as they instantly became top 10 chart hits in many countries (Whitehurst 2014).

As some would consider this a house track and not techno it shows that it is hard to distinguish those genres, especially so short after they emerged. House was known as a specific genre before and *The Belleville Three* mentioned that they were influenced by this development which happened in Chicago. As a genre, House was much more influenced by and close to Disco and Soul music which made it harder to set a clear starting point although the track "*On and on*" from *Jesse Saunders* in 1984 could be considered as one of the first ones while 1985 *J.M. Silks "Music Is the Key"* was already a big hit (Arnold 2017). Although there was exchange and friendship between Chicago and Detroit it seems they also rivaled on who invented which term as Juan Atkins said: '*In Chicago, you had the Jesse Saunders stuff and the Jamie Principle stuff and titles like "acid house" or something like that. But that was Techno! They just didn't call it that because it would give Detroit too much influence.*' While later Eddie Fowlkes would describe the '*The main difference between the two cities was that Chicago was more disco while Detroit was more funk.*' (Hoffmann 2008).

Another style often mentioned and connected to the development of Techno is Electro. This style followed the path Kraftwerk has prepared before with an emphasis on syncopated beats which could be found in their songs *Numbers* or *Home Computer* but also incorporating other styles from artists like Afrika Bambaataa or Grandmaster Flash (Degiorgio 2018). Actually, the first Cybotron and Model 500 releases could nowadays be considered as Electro as they don't follow a 4-to-the-floor

drum sequence so in a way one could say House and Electro have been there before Techno and were more the basis for Techno to follow.

This is also shown with a look at the second wave of artists that emerged from Detroit and became known under the alias of *Underground Resistance (UR).* The collective founded by Mike Banks, Robert Hood and Jeff Mills in 1990 released numerous records in different styles such as Electro (UR or Drexciya), Techno (X101, Blake Baxter) or House (on sublabels like Happy Records) and even ambient or future-jazz (Nation 2 Nation / Galaxy 2 Galaxy) often without stating who the producer was and with clear political attitude: anti-corporate, anti-establishment and DIY (Denk and Thülen 2014, p. 33). Some records were a huge success and have a big influence up until today. Jeff Mills and Robert Hood left UR in 1992 to pursue an international career which shows how influential they were at that time. This was also the case because Techno by then had become really big in Europe. Berlin played an important role as UR were invited by the Tresor-Club and built a relationship which lasts until today (Denk and Thülen 2014, p. 36). This led to the fact that the label of the club was the first to release albums of the artists X101 (1991) and Drexciya (1999).

The rise of Techno in Europe was the result of various factors. On the one hand Italo-Disco and EBM already had some success, on the other hand political events like the fall of the USSR and the Berlin Wall created a vacuum and the city of Berlin suddenly offered numerous spaces which were turned intro clubs. All this came together and '*Techno became the soundtrack of reunification-era Berlin for three main reasons: the pure kinetic energy of the new sounds, the magic of the places it was played and the promise of freedom it contained*.' (Denk and Thülen 2014, p. 2). Other Cities like Frankfurt already established a scene and played an important role in the rapid distribution which is likewise true for the UK.

The commercial success of Inner City already hinted at the commercial potential of this music and in combination with the development of Techno as a youth and rave culture events like the Berlin based Loveparade attracted more than a million people, questioning the initial motivations as being *underground* or a subcultural movement. The problems and questions which might occur due to this are being discussed in the next chapter.

Alongside these developments there were constantly new styles emerging, for example Trance or Gabber, often with a connection to a specific regional scene. This shows that is becomes more and more unclear what belongs to the term Techno as a category. In theory the term *Electronic Dance Music (*EDM) is more general and could be used instead nowadays, yet it is being used for a specific style which most parts of the Techno scene refuse to be associated with (Cijffers 2018). Hence the use of Techno as a broad category is used instead for this work; that includes similar styles and are connected to the history and musical development as described above with House and Electro. It might be controversial if styles like Drum'n'bass or Dubstep should also be included under this term as they follow different musical concepts. It is probably also a question of the regional heritage, as

those styles together with UK Hardcore were much more prominent and interlinked within the UK. For simplicity, the survey which will be conducted targets users who 'identify themselves as part of the Techno Scene'. Due to the design of the survey it can be assumed that a majority of the sample will be based in Germany so it will probably reflect this scene.

2.4.2 Underground, subculture and mainstream

As shown in the previous chapter the Techno movement became popular and created commercial potential in Europe. Yet this this was considered to be problematic when looking again at the ideas some of the originators had in mind. Robert Hood said that Underground Resistance

> '[…] *was a message against the music industry, against dependence on big, corporate music, against selling your soul to the powers that be. It was a powerful, in-your-face attack on the powers that be. Our attitude was confrontational: we make no compromises.*' (Denk and Thülen 2014, p. 33)

While this attitude might not have been shared by anyone does it show that at least for some it was more than just a new style of music emerging it was also connected with clear ideals and political motivations. This is relevant as it explains why the movement was considered to be a subcultural movement. The British sociologist Dick Hebdige describes subculture as a revolt against a *dominant ideology* or the *hegemony* of the dominant class (Hebdige 1991, p. 16). This results in the desire to *be different* which is why often opposing terms are being used in order to distinguish their own group from the masses. Sarah Thornton gives examples in her analysis of the British Rave scene of the 90s such as: ' *the authentic versus the phoney, the 'hip' versus the 'mainstream', and the 'underground' versus 'the media'* ' (Thornton 2013, p. 15). Based on Pierre Bourdieus book *Distinction* (1984) she develops the idea of a *subcultural capital* (Thornton 2013, p. 26). This leads to the buildup of cultural hierarchies within this subculture while prominent actors like DJs within this group accumulate cultural capital. This leads to standards, norms and a shared taste. In the context of this work and this could explain why there is such a long lasting tradition of analog media being preserved. It makes sense, then, to focus on one specific scene. At the same time it also functions as an explanation why these subcultures are of such high interest for the 'mainstream culture', especially for companies. They try to use the carriers of subcultural capital in order to connect their brands with attributes such as authenticity, underground or style. An example of this the cooperation between the DJ Peggy Gou and companies like Porsche or Louis Vuitton.

Figure 10: DJ and producer Peggy Gou advertising her shoe collection she created with Louis Vuitton (Newbold 2020)

This can of course only work if there is an audience big enough which promises companies a decent return of investment. The international music summit estimates that there are around 1.5 billion people worldwide listening to Electronic Music (in 2019) with a total market size of around $7.2bn (Watson 2019). While there is not such a distinction between EDM and Techno, it is still obvious that Techno is definitely not a niche scene and is already adopted by mainstream culture. This is however nothing new as Techno was already popular towards the end of the 90s. The size of the Loveparade and hits like "Somewhere Over the Rainbow" by Marusha, which already topped the German charts, triggered discussions about mainstream versus underground, between commercialization and idealism since the 90s (Denk and Thülen 2014, p. 62). This however does not mean that there are still parts of the scene which could be considered as subcultures as they can re-iterate on their standards and their definition of subcultural capital (Thornton 2013, p. 15). Often, these subcultures shift to different sub styles of certain genres or a focus on a local scene as a response (opposing the 'global, jet-setting DJ-superstar'). It seems like mainstream culture is dependent on these independent small-scale scenes in order to produce new notions of what's considered *hip* or *authentic* (Hietanen and Rokka 2015, p. 1573).

2.4.3 Analog media and techno

As described already (and as the term suggests) the development of Techno was closely linked to the development of technology and its possibilities. More specifically the musical properties (see chapters 2.2.2 and 2.3.2) also resulted from what was *not* possible. Being a minimalistic genre by style was not only a conscious decision but also due to the lack of musical knowledge of its creators and the result of the limits the hardware sets (Goldmann 2016, p. 158). An example of that are the iconic machines created by the Japanese company Roland Inc. with their x0x series. While the TB-303 (TB: Transistor Based) was meant to mimic a bass player, the TR-808 and TR-909 (TR: Transistor Rhythm) were drum machines. All these machines were initially targeted to musicians who needed a simple and affordable way to accompany their play of instruments. Starting in 1980 (808) and being reviewed as having a non-realistic, artificial sound character these products were a commercial failure and thus discontinued in 1985 (909 and 303).

Figure 11: Drummachine Roland 808 which was added to the NAMM TECnology Hall of Fame in 2020 (Geisel 2020)

It was exactly these sound characteristics which gave techno its distinct aesthetic (Goldmann 2016, p. 156). In the case of the TB-303 the new sound created by the non-resonant filter and its modulation envelope was so distinct it became synonymous with a completely new term: Acid. Starting with Acid House the prefix is being used up until today for various subgenres like Acid Techno or Acid Trance. Low second hand prices made them affordable and the ease of use made them attractive to people who didn't receive a musical education. This indeed opened the possibilities of being used in creative ways far different from the intentions of the engineers who originally created these machines.

These machines provided comparably simple controls which were easy to understand but at the same time gave enough room for altering the sounds to provide a rich diversity in order to influence different styles. Combined with a simple to use step sequencer the producers didn't need many tools or any knowledge to create complete tracks. This led to a development which could be described as the democratization of production means. Similar to punk, it attracted people who didn't have the economical or educational resources formerly required to pursue a career in the music industry and used music as a form of political expression.. As described in the previous chapter this can also be explained with Bourdieu and Thornton and their theory of the development of (sub)cultural capital, as the actors constructed their own notions of aesthetics with help of these news tools and their limitations. These limitations forced the producers to push the boundaries of these devices in order to make records with only a few pieces of equipment. For example Robert Hood who: ' *didn't have much equipment. A four-track mixer, a 909, a Juno 2, a couple of speakers and a small Yamaha sequencer. I didn't even have a sampler.'* (Denk and Thülen 2014, p. 50).

Ironically, due to their historic role within the development of techno these machines became so popular again that nowadays the prices for second hand hardware have reached their lifetime highs (Orkin 2017). This inspired some companies to recreate these machines in the form of replicas or clones (see chapter 2.3.1). The Roland x0x series wasn't the only hardware being used for creating this music, notable other synthesizers are for example the Yamaha DX7, Roland Junos or a Korg M1. It is important to mention at this point that the focus for most producers was probably not to work all analog by all means. More likely it was because these pieces of equipment were available. Also digital synths like Yamahas DX-Series were being used (Goldmann 2016, p. 162). The commercial success of some tracks (like Inner City) allowed a few actors from the early years to earn decent money and to update their studios.

The Roland TR-707 and in parts also the 909 (uses PCM Samples for Hi-Hat, Crash and Ride) already hints to a different important technological development: Samplers. Originally, they stored only prerecorded sounds (as for example the 707) while they later developed the capability to record any sound, manipulate and play them back in a programmable manner. While these machines are not analog in technical terms (see chapter 2.3.2 and 2.1) they must not be missed when describing the link between technological and musical development. Like the TB-303 which stands for the term *Acid*, Samplers (for example Akai MPCs, Akai 2500, EMU IV) were essential for genres like Hip Hop, Jungle, Drum and Bass or UK Hardcore (but of course also used for Techno). This concept of a sampler was the first concept being ported to computers like the Mac with Cubase in 1989. It took until 1996 when Native Instruments created Generator (now under the name Reaktor) which kicked off a revolution as it was an open and modular platform that enabled anyone to create synthesizers, samplers and effects without the need of programming knowledge as it used a visual interface to modules. The digital revolution was accompanied by various software innovations which added new and formerly impossible ways to create music (see also chapter 2.5.2). This fostered further

democratization of production means as by the mid of 2000s there were computers in many of European and American Households.

By now it was possible to produce music completely *in-the-box* (only using a computer without external music gear) it was no longer necessary anymore to rely on a second-hand-market of used hardware synthesizers which lowered barrier of entry even more for prospective music producers (Bürkner 2018, p. 51). As a result, analog hardware seemed to vanish and more and more manufactures stopped producing analog hardware altogether. As shown in chapter 2.3.1 it seemed the digital revolution was in full acceleration when the first new analog synthesizers were thrown into the market and started a hype. Up until today, analog hardware was always part of the sonic aesthetics of Techno but there was always a high adoption of new, digital opportunities which equally contributed to that Techno sounds like today.

A similar though less complex picture can be drawn by the role of vinyl within the techno scene. The previous chapter showed that the concept of a DJ playing back multiple records at once with a seemingly never-ending beat was adopted from Disco-Culture. But here also the technological possibilities and barriers were constitutional for the development of musical characteristics. The track-format, the low harmonic complexity, the similar tempo (as measured in BPM) and the 4/4-Beat were key elements in order to enable the DJ to play back two or more tracks at the same time. For doing so, at least two record players (turntables) were needed together with a mixer which has different functions to blend these records together. This means that the toolset of a DJ is in general twofold: there are records which can change constantly while the equipment is usually fixed. This led to another development: DJs usually did not bring their own equipment and relied on the requested and provided gear from the venue that ultimately created industry standards. The standards are extremely long-lasting, especially the record players are in use up until today: the Technics SL-1200/1210 MK2 (later also MK5 and nowadays MK7) by Panasonic is the main tool for DJs who play vinyl because of their reliability and sturdy casing which made them a perfect tool for playing in loud spaces (Rothlein 2013).

As shown in chapter 2.2.1 it took some time until digital alternatives really made an impact in the DJ scene. The inventions of DVS, DJ-controller or CDJs by Pioneer offered some alternatives but it seems like only the CDJs were adopted by a wide range of DJs nowadays, although this might vary heavily between different smaller scale scenes based on genre or region (Rothlein 2013b). It is safe to say that Pioneers CDJ/XDJ range developed the rank of an industry standard as well which is also displayed in their current market share of around 60% (McGlynn 2020).

While the DJs within the Techno scene were always dependent on the medium, this dependency also kept the medium alive while CDs and cassettes made up for a majority of the market (Gomez 2017, p. 43). Up until today there is a variety of independent small labels which produce the supply for this demand. While the vinyl revival was mainly caused by re-issues and major labels (Gomez 2017, p. 29)

the amount of labels releasing music for the Techno scene increased since the revival. This in combination with the fact that the market size was not actually growing adequately and the increasing amount of digital alternatives lead to the situation that the independent labels sold less and less, to a point where it is hardly profitable anymore. Some labels press limited editions of 300 records or less which is usually not enough to break-even (Goldmann 2015). Depending on the different configurations regarding style, design and production quality the label has direct influence on the total costs of an edition (Appendix A1). In combination with the chosen sales model (Appendix A2) it is still possible to become profitable. Assuming that an edition of 300 records and main income through a distributor could be used as a reference, it is also apparent that compromises would be required in order build a sustainable business (Appendix A3). That also created the phenomenon of *white label* releases, which were produced with minimal costs and often no to little artwork. Although there are still some labels which operate vinyl-only, some labels can afford to invest in a vinyl release when compensating for the loss with income from events, merchandise or online sales (directly through Bandcamp or with a distributor for income from other online stores, streaming and royalty services). So in total it seems like the *vinyl revival* was actually bad for the Techno scene but many labels still stick to the medium. They do this because a material release can create subcultural capital (see previous chapter) for example due to separation from digital-only labels, in order to create collectable items or to comply with norms within a specific target group. The German DJ Efdemin explains that:

> *"Many clubs and their resident DJs attached to the ethos of authentic DJing stick to vinyl, or at least mix not only the tracks but also media themselves, with physical vinyl being often at the centre of attention to them.[...] Vinyl is too big to fail you."* (Bartmanski and Woodward 2015, p. 100)

As DJs represent status, accumulate cultural capital and act as role-models this makes it attractive to labels not to lose touch with vinyl DJs, even if it is not profitable (Bartmanski and Woodward 2018, p. 4).
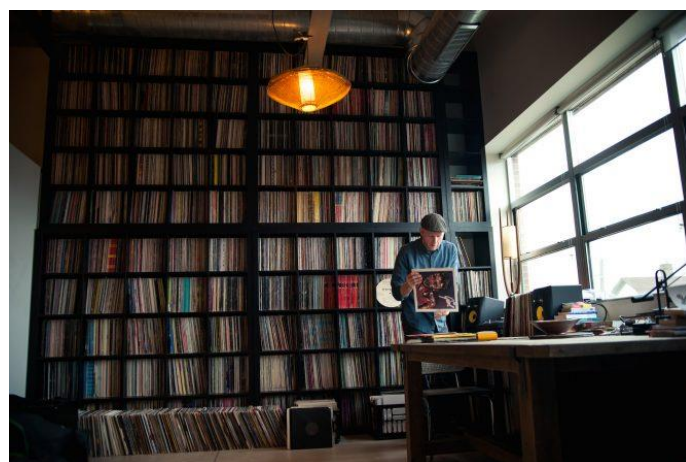
Figure 12: The American DJ DVS1 showing this record collection (Sgalbazzini 2016)

Other DJs might want to follow their idols. However there is probably a difference between DJs in stage and home situations. This has to do with the equipment provided, the confidence in live situations ore simply the fact, that there are also some DJs which only do it as hobby and are not confronted with live situations. The same applies to producers where a distinction between home and stage (*'live-acts'*) use probably results in different usage patterns or aspects which are important.

2.5 The use of analog media

2.5.1 The fascination for analog media

Whether it's vinyl or synthesizers, both have been around for half a century which is remarkable given the fact that the speed of innovations in technical areas is ever increasing with severe impact on our daily lives. As shown in the next chapter it seems likely that there is some correlation between the impact of the digital revolution and revival of analog media. But as those devices are around for such a long time there are also other factors which need to be considered. These factors could be summed up into different categories and similar approaches can be observed when looking at different authors. (Bartmanski and Woodward 2015) structure their work while looking at vinyl as record, medium, thing, commodity and totem. (Winters 2016) explores in different chapters the topics fidelity, aesthetic discourse, virtual authenticity, collectors, commodity, audiophilia and the formation of communities around vinyl. Those topics are recurring also with others authors which focus more on a specific aspect which indicates that there are different dimensions to explore resulting in a complex network of interrelated effects:

> *"This complexity resides not only in the myths and narratives surrounding the vinyl and its rich history but also in how they correspond with today's material reality and in the relational and physically mediated constitution of such pairs of meanings as old/new, authentic/contrived, original/copy, valuable/cheap or 'warm' vs 'clinical' sound."* (Bartmanski and Woodward 2015, p. 19)

Although most of the literature which is referenced is about vinyl, the fascination for analog media is not exclusive to records or synthesizers and probably also applies to other examples such as books, cameras or analog watches (Fernandez and Beverland 2018, p. 2). What unites them is the fact that they share a set of common properties which allows for auditory, tactile, haptic, visual, and olfactory experiences (Bartmanski and Woodward 2018, p. 3). It will be shown in the chapters 2.5.3.2 and 2.5.3.3 that these physical properties have an impact on our perception of ourselves and can contribute to one's identity. Besides that analog media carries symbolic values as it can function as a representation of a specific group and their norms, values and the cultural investment which is connected to that (Hietanen and Rokka 2015, p. 1579). In contrast to digital alternatives, vinyl displays a direct connection between cause and effect in a way the sound is being produced which could be related to the concept of the 'aura' by Walter Benjamin (Attias 2011). After all, it is also about music

which plays an important role in the life of many people and the love for music can also be transferred to the artifacts which are connected to it (Milano 2003, p. 18).

With all the different aspects in mind, it necessary to keep in mind that these effects and their interactions are highly contextual regarding time, region and social space (Bartmanski and Woodward 2015, p. 169) which is why this work focuses on a specific scene (Techno) and in regards to the time we are living in, which is discussed in the following chapter.

2.5.2 The analog movement within the digital revolution

It doesn't seem like a coincidence that the resurgence of analog media happened while the so-called digital revolution was in full swing (Sound on Sound 2014). That term describes the development in which digital technologies made a huge impact on human life and fundamentally changed the way we live and work together. The invention of the internet in combination with the ongoing increase in computing power with at the same time lower manufacturing costs and the form factors enabled integrating digital technology into everyone's daily life with the help of computers and smartphones and shortened innovations circles. It not only changed the way we store and exchange knowledge and information but introduced new ways to communicate and organize our social lives and consume media. Platforms and services like I-Tunes, Napster, YouTube and Spotify had a huge impact on the way the music industry works and how we listen to music (Winters 2016, p. 136). While digital technologies offered possibilities to overcome analog limitations (Barlindhaug 2007) it seems that exactly these very possibilities created the need for their analog counterparts. Ironically, the CD which was once a success story of near total domination for the industry also fed a black market, as copies were easily created with a personal computer and CD writer devices. The same fate soon awaited online stores for files which enabled labels to re-release their back catalog again but at the same time file sharing evolved quickly, allowing users to exchange digital files for free. Beginning with Napster the file sharing networks caused a huge crisis which resulted in plummeting sales.

GLOBAL RECORDED MUSIC INDUSTRY REVENUES 2001-2020 (US$ BILLIONS)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Synchronisation										0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.4
Performance Rights	0.6	0.7	0.8	0.9	0.9	1.0	1.2	1.2	1.3	1.4	1.4	1.5	1.7	1.8	1.9	2.2	2.3	2.6	2.5	2.3
Downloads & Other Digital			0.4	0.0	1.0	2.0	2.7	3.4	3.7	3.9	4.2	4.4	4.3	4.0	3.7	3.2	2.6	1.7	1.5	1.2
Total Streaming					0.1	0.1	0.2	0.3	0.4	0.4	0.6	1.0	1.4	1.9	2.8	4.6	6.5	9.2	11.2	13.4
Total Physical	23.0	21.3	19.7	19.1	17.9	16.2	14.0	11.9	10.3	8.9	8.2	7.6	6.7	6.0	5.7	5.5	5.2	4.7	4.4	4.2
Total revenue $US billions	23.6	22.1	20.5	20.4	19.9	19.3	18.1	16.8	15.7	14.9	14.7	14.8	14.5	14.0	14.5	15.8	17.0	18.7	20.2	21.6

Total Physical · Total Streaming · Downloads & Other Digital · Performance Rights · Synchronisation

Figure 13: Development of the global revenues from recorded music since 2001

Since 2015 the market is recovering with the help of streaming revenues (International Federation of the Phonographic Industry 2021)

Digital file downloads as a medium were not as important for a long time and are now being replaced with streaming services such as Spotify, Tidal or YouTube. Classic distribution networks that the music industry established are now being undermined as access to distribution networks is getting more and more obsolete with services that allow artista, bands and producers to directly publish onto streaming platforms or direct-to-customer platforms like Bandcamp (Hracs et al. 2016, p. 3). As seen in chapter 2.1, a music medium is not only about its content and sonic characteristics but also structures the way its content is consumed. It seems the focus shifted towards mobility and accessibility (Bartmanski and Woodward 2015, p. 37) as streaming services mostly work on a subscription basis or for free with advertisement, music can no longer be 'owned' and collected, only organized in playlists which could then represent their owner's taste. The customer has immediate access to everything that strengthens the importance of recommendation services. We're on the cusp of seeing this in the DJ-world where first streaming integration is being offered (Pioneer 2020), (Serato 2020). Yet it's too early to predict if this will also become an industry standard as there isn't much hardware out just yet that supports this. Even if streaming will not become a standard, the digitalization had already made a huge impact as with the invention of the CDJ or computer based DJ-

software it lowered the entry barrier dramatically as potential DJs aren't excluded on economic (because records and the equipment are expensive), social (because you are not part of socio-cultural space like a record store), or geographic ground reasons (because there is no vinyl infrastructure in the respective country or region), leading to groundswell of available DJs.

Similar developments happened in the area of music production where it was made possible to completely produce 'in-the-box'(with DAWs) meaning that only a computer was now required for the whole music production process (Arditi 2016, pp. 25–26). This significantly lowered the initial setup costs as most people already had a computer, the software itself is much cheaper than hardware or could often be downloaded illegally similar to music files and for free from file sharing networks. This has led to a democratization of production means and enabled especially young people to get into music production as the required knowledge can be also acquired online with the help of communities or tutorials. At the same time the internet enabled anyone to upload their work making it immediately available to the whole world, which in return resulted in a seemingly endless stream of new music, which makes it even harder to sell music in order to make a living (Bürkner 2018, p. 46). New business models are the result, combining tutorials, community and the supply of samples, plug-ins and DAWs on a subscription like plan ('rent-to-own'), as can be seen from the services like Splice.com (Splice 2020).

While these digital innovations obviously have a direct impact on how music is being produced and played on computers they also have a direct impact on the analog world as it seems likely that the digital revolution also caused the need for analog equipment. The analog was put into a new context with the birth of an alternative: *"When it first entered the world, the digital seemed to be the kiss of death to the analog. Nowadays the idea of the 'analog' record makes sense again, and it is not despite but partly because of digitalization."* (Bartmanski and Woodward 2015, p. 23).

2.5.3 Motivations and reasons for analog use

2.5.3.1 Sound attribution and characteristics

Vinyl and synthesizers are auditory media in the way that they produce sound. That's why it is no surprise that sound is one of the main characteristics which are being talked about when comparing different products. While it is probably not *only* about sound it is still necessary to pay attention to one of the aspects which is argued about a lot. Often enough attributes such as 'warm' are used for analog techniques while the digital is 'cold' or 'clean' (Richardson 2013). Those attributes usually refer to sonic characteristics and in the chapters 2.2.2 and 2.3.2 it was already shown that there are indeed specific technical properties which shape the sound. It cannot be the scope of this work to examine

whether these attributes are true and useful; furthermore this will also not examine whether something is better or worse than the other. In fact, it might not even matter if there is an audible difference at all: Dave Rossum, founder of E-mu systems, mentioned that *'if you believe the audio is produced by a more expensive or otherwise superior system, the sound it makes will be more pleasurable.'* (Mantione 2017). Still it seems that there are obvious differences between analog and digital. For the vinyl it was described that there is a loss of high frequencies with ongoing playtime while the bass needs to be cut in mono in order to playback properly. In total it seems like it is exactly these shortcomings which provide the record with its distinct sound characteristics which make it likeable or as Robert Rich put it when comparing it to digital files:

> *'vinyl sounds worse, but it sounds worse in a way that we like. To master a vinyl LP we need to remove everything under 40 Hz or so, we need to compress the dynamic range more to overcome surface noise, reduce stereo width. The inherent pops and clicks, rumble, narrow stereo image make LPs technically inferior.'* (Mantione 2017)

When looking at Synthesizers the picture becomes less distinct. This is due to the fact that there is not *the* one synthesizer to compare against but every product will have their own unique architecture, so does every plug in. Still, it seems that,

> *'it's the imperfections that people are drawn to. Subtle distortions, nonlinear envelopes and idiosyncratic oscillators are all part of the charm. Even tuning instabilities can help contribute to a thicker, more organic sound, by creating a kind of chorus effect when multiple oscillators are layered. All these things add up to analogue synths feeling more like 'real' instruments than their digital counterparts, which are often accused of sounding 'sterile' and 'lifeless'. (Sound on Sound 2014)*

Also, every product is unique because of the way it is produced. While any digital file is a copy it is assumed that every program runs in the perfectly exact same way. This is not given for hardware as David Smith mentioned that

> *In our products, specifically analog polyphonic synthesizers, analog has a huge advantage over digital. Every voice is a completely separate circuit, so they are never exactly the same. When combined with the sound of analog voltage-controlled filters, the instruments have a transparency and ability to blend in a very acoustic manner. Digital synths can (and do) sound very good also, but musicians always tell me how much better the analog instruments fit in the mix.* (Mantione 2017)

Both synthesizers and vinyl seem to have in common that distortion is especially important for the character. Andreas Lubich says: *'It's about distortion, and in the best case, harmonic distortion. That's what happens with tube processing. Depending on how you treat it, that happens to tape or reel to reel, but especially to vinyl records.'* (Bartmanski and Woodward 2015, pp. 65–66).

So in either way, it seems there is a mix between effects which are actually there and the ones which are implied due to the medium itself. For the focus of this work it actually doesn't make such a big difference if the effect is really there. More important will be if the user thinks it is there and if this is relevant for choosing which medium to use.

2.5.3.2 Haptic, performance and virtuosity

When comparing digital to the analog world the most obvious difference is the physicality of the analog devices, in the way that human can touch and interact with them which is also the basis for performing with them and playing them in a virtuous way. As the line between the digital and analog is becoming increasingly difficult to differentiate, especially in the world of synthesizers as some devices combine digital and analog technology. In the DJ domain we can observe that multimedia players and controllers became common which are also physical devices. So actually, physicality might not even be the decisive factor between analog and digital. Still, it is often mentioned and needs to be looked at as there are many words to describe the impact such as tangibility, haptic or physical involvement (Styvén 2010, p. 1093). While there are different aspects to this topic they all have in common that humans like and need to interact with their surroundings while engaging multiple senses (Fernandez and Beverland 2018, p. 9). This was described by Russel W. Belk in 1988 in his work *Possessions and the Extended Self* where he mentioned that we are able to exercise power on external objects which can then help to *extend* ourselves. Trough constant training the connection between the human and object can get closer (Belk 1988, p. 140). This could manifest itself as '*for nowadays music listeners, listening to the sound of a vinyl record should result in increased emotional arousal compared to listening to the sound of a digital audio medium*' (Lepas and Tritakis 2016). In addition, as a DJ you use vinyl not just for listening purposes but also to learn a craft, practice and invest time into something you want to achieve (Bartmanski and Woodward 2015, p. 55). Mathew Jonson describes a similar sensation with his attitude to analog gear;

> *There's always a learning curve, and that's kind of why I enjoy buying synthesizers. The things I'm learning now aren't necessarily so much about the synthesis, it's more learning the actual, like, how does the gear work, what menus do you have to go through, what are you diving into with the machine? (Rothlein 2015)*

Synthesizers, especially from older times, can be more rewarding because in the absence of presets the user is forced to get creative and program the sound themselves (Boothroyd 2013). This is also due to the fact that there is a more direct interaction between human and machine possible which is the result of …

> *[...] the user interface. Most analogue synths (with a few exceptions) have a oneknob-per-function mode of operation, which makes editing patches and performing realtime adjustments a simple and immediate affair. By contrast, digital synths tend to economise on knobs and sliders, often requiring shift keys to access parameters, or worse, hiding functions within multi-layer menus. (Sound on Sound 2014)*

For DJs the difference in the interface is even more profound. Records and the turntables they play on usually only allow the actions start/stop, pitch of the speed and a selector for 33/45 rpm. Digital devices on the contrary offer (touch)screens, many buttons for additional functionality like loops and cue points or for browsing file systems. This also results in a different set of required skills. As a digital setup usually allows to *sync* two tracks (which is also reflected in H4.3), the vinyl DJs has to

manually beatmatch[1] which especially in a live situation always populates the risk of failing a transition and thus requires a lot of attention. Mastering this skill can be part of the self-perceived virtuosity *(Attias 2011)*.

2.5.3.3 Materialism, collecting and owing material

Another aspect of physical objects compared to their digital counterparts is the way we obtain and possess them. Every object requires physical space to store and even it's a mass-produced object it is unique and limited in a physical way while a digital file is literally just a copy of a copy and 'just' an array of zeros and ones. This introduces the effects of rarity of specific objects and prestige in displaying your collection. There are many theories about how objects, their possession and collection are part of us, for example '*The System of Objects'* from Jean Baudrillard (1968) or Walter Benjamins Essay '*Unpacking My Library*' from 1931. They have in common that objects and their collection are being considered as part of our identity (Styvén 2010, p. 1089) and produce an 'extended self' (Belk 1988). This means '*that aspects of identity, memory and feelings of security about one's past and future are materially anchored by objects'* (Bartmanski and Woodward 2015, p. 117). A personal collection mirrors not only one's taste but connects it to the time, is unique as one's own personality and works as a representation of this (Milano 2003, p. 18). And it is this very representation which cannot happen as such if it only exists as files on a hard drive. Presumably, it's also less likely to develop emotional feelings towards files than one would towards physical objects (as shown in previous chapter). This can lead to an increased desire to own important pieces as physical copies (Giles et al. 2007, p. 442). The uniqueness of a collection leads to the fact that it has a different meaning for everyone, which results in that '*[…] there is no such thing as a "typical" record collector, particularly now as cultural studies and social science refuse to let themselves be bound to what lies on the surface'* (Hracs et al. 2016, p. 192). While there are many thoughts about the collection if vinyl, this can also be true for synthesizers as Mathew Jonson states in an Interview for the Resident Advisor feature called *Machine Love*:

> *The way you talk about collecting synths reminds me of the way diggers talk about buying rare records. Would you call yourself a synth digger?*
>
> *MJ: Yeah, it's exactly the same. You can go into a record store in New York where they've got tons of stuff and spend thousands of dollars on rare disco records or something like that. But is that necessary? And is it worth that much? It's the same in the synthesizer world, like prices for analog equipment have skyrocketed. And the inflation on them is totally insane, and in my opinion most of the synthesizers are not worth paying the amount of money that you find them on German eBay for. Because we're in*

---

[1] process of aligning two (or more) tracks in speed and phase which is done via sync by computers automatically

It becomes clear how important such a collection can be if it makes you want to buy things which you know 'are *not worth paying the amount of money*'. This may also be caused by the limited availability of an object due to their age or limited edition production which actually happens for vinyl and synthesizers (for example the reissues of Moogs Model D with walnut front). This rarity and the emotional value which the object can obtain for the personal collection can lead to an increase of prices which makes the items even more "collectible" because it can also work a representation of one's economic status (Bartmanski and Woodward 2018, p. 3). The required economical investment can at the same time exclude many or at least feel exclusionary.

In this way the collector interacts with others, either by showcasing their collection or sharing their passion at a communal place like record stores. The physicality of the medium connects people with spaces where like-minded people can meet although this is probably a scenario which is more relevant for DJs and record stores. (Bartmanski and Woodward 2015, p. 57).

2.5.3.4 Digital possibilities and analog limits

In chapter 2.5.2 it was shown that it's not unlikely that the recent rebirth of analog media is probably influenced by the digital revolution. While it seems that there are numerous advantages of digital alternatives (chapter 2.6.2) people still tend to use the analog hardware and one reason for it can be the seemingly endless possibilities that seem to be overwhelming at times. Analog media acts as a counterweight to the fast, ever innovating digital world as a slow medium which Jennifer Rauch describes as:

> *'[...] a broader re-appraisal of modern culture taking place in the 21st century. It challenges the notion that one's default speed in daily life should be "as fast as possible" and contends that you can only understand fast, digital media by recognizing and slowness in media confronts flaws in an industrial system driven by short-term gains, global inequality, shoddy products, unfair labor practices, environmental degradation and unsustainable consumption. Books and records are the only specific print or analog media mentioned in their 800-word statement.'* (Rauch 2015, p. 4)

In interacting with slow media, we '*run counter to the furious momentum of digitised contemporary culture, its speed and its pursuit of sanitised perfection – of sound, image and format.*' (O'Hagan 2011). It becomes clear that it is not about being faster or making use of every option but to limit yourself which can also be useful in a creative way. Brion Eno ones said that *'everybody works better with fewer possibilities'* (Dax 2001) and Matthew Herbert even goes one step further in his Manifesto, where we collected a set of rules on how to write music which basically consists of a list of things not to be used (Herbert 2011). While this might be personal preferences of single composers and producers it is still relevant as the focus for this work is specifically on the techno scene and it's music which is as shown in chapter 2.4 the result of limitations and reduction. These limitations were given

by external factors due to lack of money, knowledge or technical possibilities (Denk and Thülen 2014, p. 50) and had a direct impact on the aesthetics of the music, which nowadays is at risk given the sheer endless possibilities: *'In the past, producers were restricted by the more primitive music-making technology of the day, but in our new world of unbridled possibilities, those limits have disappeared. If you want to be more productive, sometimes you have to create the barriers yourself.'* (MusicRadar 2018). This can also be true for vinyl as the DJ Phillip Sollmann, known as Efdemin, mentioned: *'It's such a big difference if you work with a selection that you have made before. You have to deal with what you have. Or, you have these unlimited possibilities on your stick.'* (Bartmanski and Woodward 2015, p. 70). But there is also another side to it in the way we value music. Simon Reynolds argues, recorded music lost value because it is so easy accessible and basically for free (Reynolds 2011, p. 124), which drives the value and also the attention we pay towards vinyl. The Hamburg based DJ Helena Hauff confirms this saying:

> *For me, personally, I feel like listening to music digitally I just don't pay as much attention, I tend to skip through it a lot, whereas with physical formats I tend to take the whole listening process a bit more seriously. I get the impression that in the modern world it seems like it's getting more and more difficult to concentrate on something and people (me included) get distracted very easily.* (XLR8R 2017)

Another aspect to this topic is also the fact that the work environments have drastically changed over the course of the last 30 years leading to a situation where many of us spend many hours in front of screens for the purpose of work, learning, entertainment and even socializing. Making music used also to be an activity which happens without a computer and analog media enables the users to go back to that state and not be dependent on a screen. Still it also must be considered that the advantages digital devices offer are tempting and have an impact on those choice of the preferred medium.

2.5.3.5 Retromania, nostalgia and personal history

While in the previous chapter it was shown that digital demands push back on some people but it can also have different reasons why people would like to go back which are caused by tradition, nostalgia and the general fascination for older times. The latter was described by Simon Reynolds as Retromania, a term which describe the re-century, a time determined by the prefix 're-' as in Revival, Reissues, Remake (Reynolds 2011, pp. 18–19). The term itself originates from the word 'retro' which 'refers to a selfconscious fetish for period stylisation' (Reynolds 2011, p. xii). Nostalgia works in a different way as it is mostly based on personal experience which can cause a strong emotional arousal, as confirmed in a 2015 study by Lepas and Tritakis, stating that:

> *'For nowadays music listeners, practically interacting with the familiar sound and sensory appeal of an obsolete medium of one's own past such as the vinyl on a record player should lead to increased feelings of nostalgia compared to interacting with non-obsolete media forms'.* (Lepas and Tritakis 2016, p. 19)

Nostalgia might be the most obvious explanation (synthtopia 2016) and it certainly is important for those who had a biographic history with the medium but it lacks explaining the fascination by people who didn't:

> '[…] *personal nostalgia is a common reason for preferring vinyl, especially among older people who have personal lived experiences of that technology in its heyday. However, the passion for vinyl cannot just arise from personal nostalgia, as some consumers who were born after vinyl was superseded also prefer vinyl.*'(Fernandez and Beverland 2018, p. 4)

Around 50% of the customers of vinyl are aged under 35 (Winters 2016, p. 53) and in the techno scene it might be even more as it is a youth culture so nostalgia might not apply. Retromania could work as a theory as it refers to a general admiration of a former period which might be relevant especially for the techno scene as the 1990s are considered the golden time of techno music by some enthusiast which also explains the recent revivals for Trance and 90s style rave techno (McGraw 2017). Also, the numerous re-issues of classic synthesizers and drum machines by Behringer shows that there is a need for 'old' hardware which represents the traditional way of how Techno was made (for example with the 808,909,303 and 101) which allows one to identify oneself with a specific era (Belk 1988, p. 149). On the other hand, Retromania might not only apply on re-issues or remakes but especially for vinyl as Bernardo Alexander Attias (2011) argues, that vinyl holds a special kind of aura which is based on the ability of vinyl to reproduce the past. This is not true for digital files as they are only copies and reconstructions of the past, while a vinyl record is a totem of the time it was produced and an authentic representation of the time which can be even more expanded when connected with a personal story which shows that retromania and nostalgia can also work together (Attias 2011).

2.5.3.6 Scene and authenticity

Music and culture in general are products of social systems so it is likely that there are also social influences which contribute to our choices when making music. More specifically there are probably general influences which are based on the time we are living in and others which are based on being part of a community like the techno scene. All these influences could be the result of trends and hypes, role models and the urge of being part of something in order to represent values and authenticity (Belk 1988, p. 153). The latter is of special importance as it is works as a concept to support how subcultural communities are being build and held together. Hans-Joachim Bürkner (2018) mentioned that authenticity, which could also be understood as *street credibility*, is essential for the construction of exclusivity and stability of a scene while at the same time providing guidance on how norms and aesthetic values are being displayed and produced (Bürkner 2018, p. 47). It also works as a gate-keeper as the process of *authentication* establishes new and used technologies within a community with so-called "circles of resonance" (term by Paul Valéry) which legitimizes new standards and the common understanding of skills and aesthetics (Attias 2011). It's important to understand that the

results of this processes can vary greatly for very specific sub-scenes which are based on even smallest local or stylistic differences resulting in an ambiguous picture when looking at the techno scene as a whole (Bürkner 2018, p. 49). While vinyl might often be used by Techno-DJs in the city of Berlin, where one can find a solid infrastructure of records stores and stables setups in the Clubs, this might not be true for Trance DJs from Brazil, where there is not such a good infrastructure and the music might be mainly released on digital platforms only. This results not only in different notions of authenticity but also plays a role in the construction of role models. These role models can have a great effect as they display symbols of success and can function as orientation, especially for new members of a scene when looking at how successful actors are working:

Figure 14: Mathew Jonson in his Studio for the Series: Machine Love (Rothlein 2015)

Besides those scene specific influences it is also likely that there are more generic influences which originate in the current state of the society where the digital revolution definitely plays an important role. Thus, '[…] *Vinyl users cope in a digital world by separating music technology from other technology. As digital technology cannot be avoided, they seek to materialise authenticity in a constrained area of their lives – in this case, vinyl music.*' (Fernandez and Beverland 2018, p. 18). As mentioned before, the loss of aura and authenticity caused by digital files strengthen in return exactly those values for the analog world (Winters 2016, p. 56), (Rauch 2015, p. 4), (Gomez 2017, p. 30).

2.6 Comparison between vinyl and synthesizers

2.6.1 Physical properties and social impact

It may have already become clear that synthesizers and vinyl share common properties. In this chapter I will summarize those in order to make clear where the differences lie which might have an impact on the usage of those media.

Being analog media and physical objects they share that they require resources and money in order to be made, take up physical space in their owners home. As it is not possible to download them for free in anyway so they have a certain value as they need to be acquired, stored and possibly maintained. A major difference is the fact that analog synthesizers are in general more expensive then records. Although there is an initial investment necessary for the setup of turntables (see chapter 2.2) analog synthesizers costs in general several hundreds of euros so there an obvious difference in required economic capital.

Analog hardware usually needs to be learned in order to use them as no computer can take over several tasks (unless they are only being acquired for collection purposes). Records are easier to collect as they take up less space to store and are cheaper to buy.

Their physical properties have direct impact on how they are being used and produce sound which makes them also share a vulnerability towards physical impacts which results in imperfections and certain sonic characteristics, such as noise, distortion, dirt or ware off. As shown in chapters 2.2.2 and 2.3.2 these imperfection are possibly a reason for the distinctive and preferred sound characteristics.

Apart from their technical and physical properties they share a similar history within the techno scene (see chapter 2.4) and resurged during the mid-2000's although it already became clear that the so-called vinyl revival was mostly caused by major labels which in return harmed small techno labels which cannot be related to the area of synthesiters. This might be caused by the fact that the typical production setup doesn't follow an industry standard and is more based on personal taste and preferences as it is built within a (home) studio and thus exposed to ongoing innovations caused by the mechanics of the market economy. While there is also a seemingly never-ending stream of new releases on vinyl most DJs stick to industry standards which are the Technics SL1200s and Pioneers CDJs which supports the transitions from being vinyl-only DJ to also using digital formats.

It is this highly dynamic market of on new records being released which allow for interaction in social places like record stores, where DJs meet like-minded people in order to connect and exchange. This is usually not the case for synthesizers and producers. If these differences and similarities really apply in the way they are being used will be one of the key results of this work.

2.6.2 Digital alternatives

Parallels between vinyl and synthesizers can also be found when having a closer look at their alternatives because it opens up the perspective on their position within the digital revolution. In the beginning the digital world tried to mimic the analog in regards to tactility and appearance in offering DVS systems for DJs (which were played like normal vinyl) and virtual analog synthesizers for producers which basically looked the same but offered different ways in modeling sound. A huge step forward was being made when computers became cheaper, more available and a tool of daily use. This made it possible to offer completely software-based alternatives which excelled hardware solutions in many ways by the following categories:

- Economical: As software is an immaterial good it only requires resources for development and can afterwards be copied without limits. This makes them much more affordable or even available for free (in case of open source, free download or software piracy)

- Mobility: As only a computer is needed and mobile devices such as laptops and smartphones are available, making music (DJing or producing) is not bound to a location and can be easily be changed as basically the whole music collection and music studio fits into a computer and / or USB stick. Nowadays as web based cloud storage is available, files are not even bound to a physical end user device making them accessible everywhere where the user has access to some kind of computer and the internet.

- Availability: Usually only a working internet connection is needed to immediately access software based media making the consumer independent of current location (is there a shop close by which offers the product), time and availability (as hardware as a physical object it is limited by nature and often old hardware is not produced anymore or was only a limited edition from the start)

- Continuation: Software is never final and can always be extended. Bugs can be corrected and user requested features can be implemented (although nowadays a lot of hardware synthesizers offer also some kind of operating system which also can be updated)

- Accessibility: Software based solutions are more flexible and can easily be extended to make it accessible to disabled users for example adding feature for example for visually impaired users

- Durability: In theory, once a running and working code is compiled it cannot break (while physical objects are exposed to external influences) and could run forever. Practically most programs rely on external libraries, drivers, operating systems and architectural design (32 vs 64bit) which makes them vulnerable and often requires maintenance

- Universality: Once the software or file is being acquired it can be copied and used without limit. For DJs that means there can be always a backup in case a file is corrupted or being lost. Producers can use a plug in or program multiple times for example a reverb can be used on countless tracks at the same time although only purchased once

At a first glance it looks like the digital advantages prevail their analog counterparts but it is obvious that there are good reasons for customers to stay in the analog world, which are to be confirmed in the chapter 5. It is also important to understand that some of these advantages are in fact disadvantages. For example, as software is immaterial and usually cheaper it cannot work for collecting for the purpose of constructing social status through distinction (see chapter 2.5.3.3).

While both, vinyl and synthesizers, share the same challenges regarding their digital alternatives it is crucial to have in mind that musical instruments are backed by an industry that tries to counter their competitors through innovation, new products and strategic marketing campaigns while vinyl as a technology doesn't leave much room for innovation and the music released through the medium is usually not exclusive as it is also released digitally. Still, the latest developments are happening in both worlds in which they seem to share as a goal to move out of the computer and offer standalone products that were made possible due to the lower prices for computing hardware and (touch)screens. Examples in the DJ world include Pioneers CDJs (among the hardware from competitors like Denon) which are basically standalone media players (the XDJ series doesn't even supports CDs anymore and only plays back media from a USB stick). For production, Akai launched a series of standalone MPC hardware (and thus coming back to their beginnings as the old MPCs also used be standalone) while other manufacturers are offering synthesizers again which are solely based on software synthesis (such as ASMs HydraSynth). It seems like not only the revival of the production and DJ tools are linked but also the developments of their alternatives which is another hint that there seems to be connection between those worlds.

2.6.3 Vinyl und synthesizers within the techno scene

In order to take the scope of this research into context it is always necessary to look after specifics which might occur within the techno scene as its functions as a social system with its norms and codes (see chapter 2.4.2). While the birth of Techno was closely linked to analog media and always stayed present (Gomez 2017) it was shown that the general development of the rise of synthesizers and vinyl is not happening as they were always present, so they were actually not in need of a rebirth. Therefore, main actors of the scene always acted as role models for analog media that for a long time was the standard.

As the development of musical structures was also linked to the technical limitations the machines set, making Techno a genre based on a minimal approach. This has not changed until today which in return also set the standard on what tools to use which is probably the reason why some iconic machines (like the Roland TB-303 and it's clones and emulations) are still in use today. Still there were always producers trying to work with newest software in order to create new sounds as Techno (and related styles) was always centered on sound design so new ways of creating sound were always of interest.

This it is also being represented in the tools for DJs: other styles such as Hip-Hop were much more open to innovations from a technical perspective and new products were more adopted (leading to techniques such as *controllerism* which describes the heavy use of midi-controllers for controlling software). There were a few famous DJs like Richie Hawtin or Chris Liebing who were propagating the use of new technology as in integral part of Techno as a music genre:

> '*Because of my prior fascination, when computers started to come into the DJ booth in the late '90s with things like Final Scratch, I jumped onto it right away. I have always felt so connected to technology, it has always allowed me to do things I never thought possible*' Richie Hawtin in (Fischer 2017)

Aside for the fact that the majority of DJs uses a minimal set of tools for a minimal style of music the standard "two-decks-and-a-mixer"-approach is relatively unchanged up until today with only the media players or number of decks changing (Bartmanski and Woodward 2018, p. 2) . In total it is likely that there are only a few actors left who work entirely analog, meaning without the interaction with any digital technology. The majority uses both, digital and analog technology. On the other hand, many users employ only digital technology no matter if it's DJ or Production domain.

3 Hypotheses and research questions

After a brief overview of media in general, the specifics of vinyl and synthesizers have been discussed. This was necessary in order to connect the current state to the history that has an impact on the perceived image of the media and their importance in the development of certain styles, genres and scenes. Based on the claim that *the medium is the message*, the technical and material properties play an important role on attributes such as sound or authenticity but also on how they can be used and be distinguished from one another. All of this can be framed in perspective of a specific scene, in this case the *Techno Scene*. As shown this is more a cultural distinction then a definition of a specific genre. The concept of *subcultural capital* helps to understand the importance of scene specific norms and standards which function as overarching boundaries. Within this frame, different aspects for motivations of media usage were explored and summarized in categories. These categories provide a

theoretical framework and result in specific hypotheses which are the foundation for some research questions and it is assumed that those are relevant across all groups.

<u>Sound attribution and characteristics</u>: As sound storing media vinyl and synthesizers are often connected with their sonic characteristic based on physical properties or the image and history of the medium itself.

H1.1: Using analog media is (positively) dependent on thinking that analog sounds different.

H1.2: Using analog media is (positively) dependent on thinking that analog sounds better.

<u>Haptic, performance and virtuosity</u>: As analog media are material objects humans interact with them in multiple ways as extension of themselves or as part of a performance to show their skills and virtuosity. It can be assumed that these effects are based on personal experience which is why these hypotheses will be tested for the according interaction effects.

H2.1: Using analog media is (positively) dependent on the preference to touch and interact with objects.

H2.1b: The effect of the need to touch on the usage of analog media is moderated by the amount of personal experience with analog and digital media.

H2.2: Using analog media is (positively) dependent on the assumption that it requires more skill.

H2.2b: The effect of the assumption of required skill on the usage of analog media is moderated by the amount of personal experience with analog and digital media.

H2.3: Using analog media is (positively) dependent on the assumption that it is more fun.

H2.3b: The effect of the need to touch on the usage of analog media is moderated by the amount of personal experience with analog and digital media.

<u>Materialism, collecting and owing material</u>: As material objects, analog media can be collected and functions as a representation of one's identity which raises their perceived value. This way they can also connect people as part of social activities while they can also exclude people because of the economic investments which are required.

H3.1: Using analog media is (positively) dependent on the need to collect and possess analog media.

H3.2: Using analog media is (positively) dependent on the perception that physical items are more valuable.

H3.3: Using analog media is (negatively) dependent on the perception that physical items are too expensive.

H3.4. Using analog media is (positively) dependent on the social activities which are connected to it.

Digital possibilities and analog limits: Part of the fascination for analog media comes from the revival within a digital world. They provide clear limits in a digital world with seemingly endless possibilities. Still it needs also to be considered that digital tools offer many possibilities and functions.

H4.1: Using analog media is (positively) dependent on the preference to work without a screen.

H4.2: Using analog media is (positively) dependent on limits of analog media.

H4.3: Using analog media is (negatively) dependent on possibilities digital devices offer.

Retromania, nostalgia and personal history: As analog media is already around for such a long time, it has a cultural history with associated values which also connect to a fascination for older times or one's own history.

H5.1. Using analog media is (positively) dependent on the appreciation of older times (Retromania)

H5.2. Using analog media is (positively) dependent on the importance it had one ones past (nostalgia)

H5.3. Using analog media is (positively) dependent on the way it was learned

Scene and authenticity: As the scope of this work is framed by the *Techno scene* social norms which result in notions of credibility, authenticity or style are being created by role models or prominent actors of the scene. The understanding of subcultural scenes can also lead to very specific differences for example of local scenes.

H6.1: Using analog media is (positively) dependent on scene specific standard set by role models

H6.2: Using analog media is (negatively) dependent on scene specific standards influenced by regional limitations such as infrastructure

All these hypotheses will be used to answer some the following research questions (RQ2b, RQ3b & RQ4). As shown chapter 2.3.2 the term *analog* is widely used but actually not well defined in the world of synthesizers. To understand how the term is understood the first questions to be answered will be:

> *RQ1: How is the term analog understood in the context of synthesizers from the perspective of a producer within the techno scene?*

> *RQ1b: Does a different understanding of the term analog also result in different user groups with distinctive characteristics?*

A focus of this work is to understand why and how analog media is being used. Therefore a set of research questions will focus on different areas, distinguishing between DJs and producers as well as between home and stage use as there might be different between the performance situations (chapter 2.4.3).

> *RQ2: How much is vinyl being used by DJs of the Techno scene and does the usage differ between home and stage performances?*

> *RQ2b: What are the reasons and motives for the usage of vinyl by DJs of the Techno scene and do they differ between home and stage performances?*

> *RQ3: How much are analog synthesizers being used by producers of the Techno scene and does the usage differ between home and stage performances?*

> *RQ3b: What are the reasons and motives for the usage of analog synthesizers by the producers of the Techno scene and do they differ between home and stage performances?*

With the result of these questions the focus can be broadened in order to compare the groups of DJs and producers which can reveal overarching patterns or specifics of the user groups:

> *RQ4: What are the similarities between producers and DJs of the Techno scene regarding the reasons for and amount of usage of analog media?*

4 Methods

In order to answer the research questions a survey was created and conducted among DJs und producers who identify themselves as part of the techno scene. The survey was active for one month between mid of January to mid of February of 2021. It was be distributed through various online channels such as social networks, newsletters, forums or personal contacts resulting in a non-probability sampling method based on a voluntary response sample model.

The survey distinguishes between DJs and producers based on a definition which was provided in the beginning:

> *For this survey, a DJ is anyone who combines tracks into a DJ-Set. This can be done via Vinyl Records, Digital-Vinyl-Systems (Timecode), with multimedia players like Pioneers CDJs / XDJs, digital Stand-alone-systems or with a software like Traktor (Native Instruments) or Serato with optional use of controller-hardware.*
> *A producer is everyone who creates their own tracks, no matter if you are working entirely analog, completely 'in-the-box' (only with a computer) or anything in between.*

Afterwards it continues with a segment tailored to the specific area followed by general questions for socio-demographic and economic information. Exclusive to producers the survey begins with the question about the understanding of the term *analog* in the context of synthesizers, asking to exclude specific components which should not be part of the users perspective of an analog synthesizer. This is necessary to answer the first research question (RQ1) but also in order establish a comprehensive basis which is being used in the questions to follow. For DJs, this was not necessary and a definition of an analog DJ medium was provided instead:

> *The following questions are about your opinions and usage of different DJ media. Analog media in this context is considered vinyl records. Digital media can be anything which involves some kind of computer, such as Digital-Vinyl-Systems (Timecode vinyl), a computer-controller-setup (or similar), standalone-devices or the use of multimedia-players such as Pioneers CDJs/XDJs. For the next questions, I will refer to all digital DJ media as Files. Please think of your setup and and your used formats.*

The specific parts for DJs and producers asked for the usage of analog media in home and stage (live performance) environments (used for RQ2 & RQ3). A set of 17 questions follow which are used to find out about motivations and attitudes in order to answer the research questions RQ2b and RQ3b. These questions were designed with a six point likert scale[2]. Afterwards, further questions were asked about preferred genres, demographic information, how much time and money is spent on different media. These are not only necessary to describe the sample but also to answer parts of the research questions (RQ1b: description of user groups based on understanding of the term analog) or some

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[2] 1 strongly disagree - 2 disagree - 3 somewhat disagree - 4 somewhat agree - 5 agree - 6 strongly agree

specific parts of RQ2b and RQ3b (interaction effects) which are based on the experience with analog and digital media. This information is used to create groups with the help of clustering methods.

These can later also be used in the main statistical models which are required for the remaining research question RQ2-RQ4.

As a general approach a regression model is necessary to determine the relationship between the usage of media (dependent variable) and the different motivations (independent variables) as main effects. As there are producers and DJs which are distinguished by home and stage usage a set of four dependent variables will be tested independently. It is likely that the outcome variable will not follow a normal distribution and as it is measured in percent (and thus limited) a linear model will not work. Hence, an ordinal regression model will be used. Therefore, the dependent variables were discretized with different resolutions. With the help of these and the choice between different link-functions a model needs to be chosen which fits the data best. General information like gender, purchase power or age is also being added to the model as control variables.

Afterwards the interaction terms can be included in the model in order to test for the hypotheses *H2.1b prefer touch*, *H2.2b requires skill* and *H2.b more fun* as part of RQ2b and RQ3b which consists the clusters based on experience as describes above.

This results in a model of 17 main effects and additional three interaction effects to a total of up to 23 terms (including control variables).While RQ2 and RQ3 focus on the specific areas the outcomes of these different models will also be used for the final research question RQ4 which compares the DJs and producers in order to find overarching patters or differences.

For all statistical analysis SPSS Version 22 will be used.

5. Results

5.1 Sample and participants

In total, 376 participants started the survey of which 285 (75,8%) completed it. All further analysis and sample description are based on those subjects who completed the survey. The sample is heavily male-based (86% in total, 86,2% of DJs, 90% of Producers (Appendix B 1.1)) .The subjects were based in 27 different countries while 66% of them came from Germany and 40% from Berlin (Appendix B 1.2). The participants were born between 1959 and 2001 while most of them were born

after 1987 (1985 for DJs, 1987 for Producers, Appendix B 1.4). Most of them (162 in total/56,8%) identified themselves as DJs and Producers.
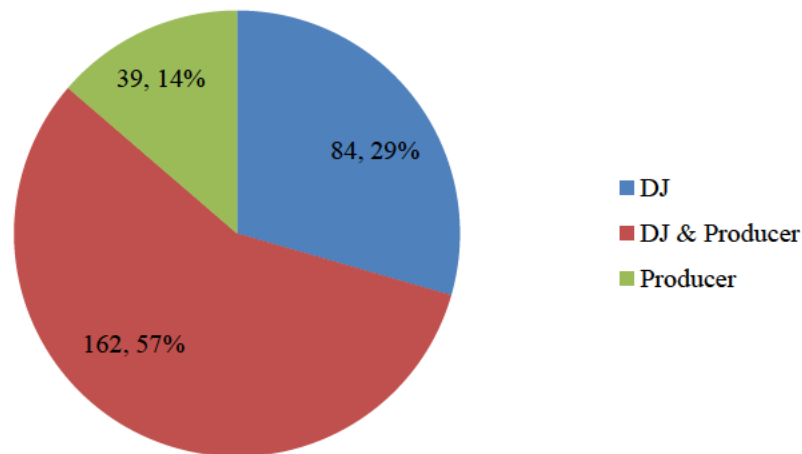
Figure 15: Amount of DJs and producers

In both groups, amateurs ('*with some public gigs, not financially dependent*') were the majority while the group of professionals on the DJ side was bigger which is balanced by more producers in the hobby section.
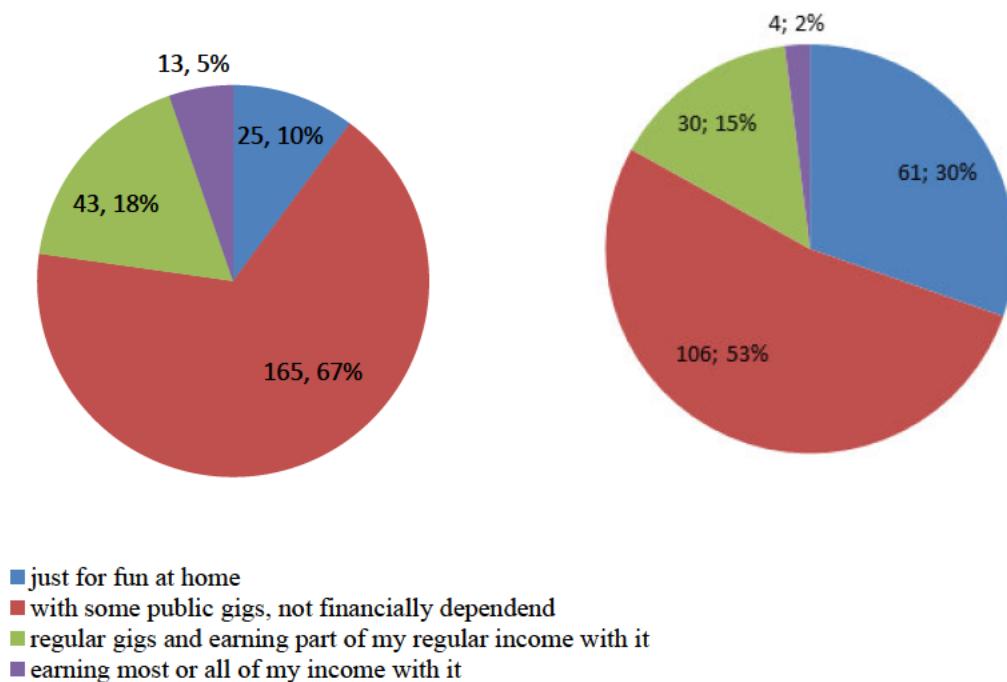
Figure 16: Degree of professionalism of DJs (left) and producers (right)

DJs spend an average of €80 on vinyl and €44 on files per Month (€957 vinyl / €535 digital per year) while 90% of them spend €150 or less on vinyl and €100 or less on files.
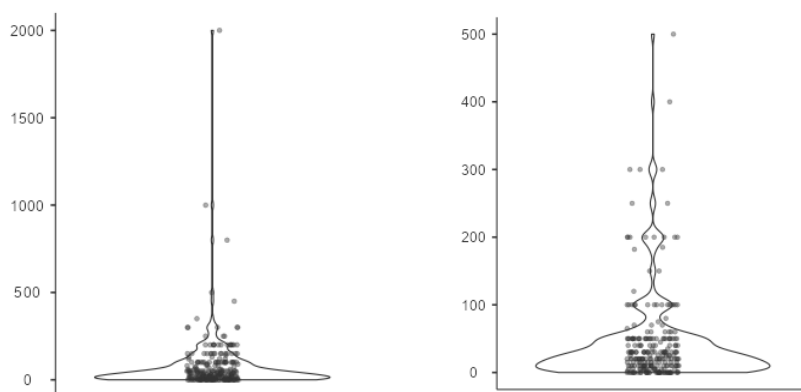
Figure 17: Average spending of DJs per month in € on vinyl (left) and files (right)

It is obvious that there some outliers and extreme values. Zooming into the 90-percentile provides a better picture:
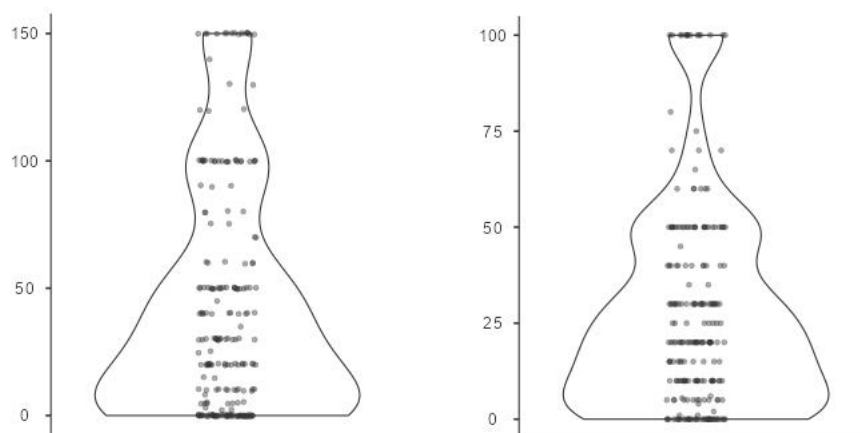
Figure 18: 90%-percentile average spending of DJs per month in € on vinyl (left) and files (right)

Producers spend an average of €840.1 on analog devices and €354.7 on digital per year (€70 / €29.56 per month).
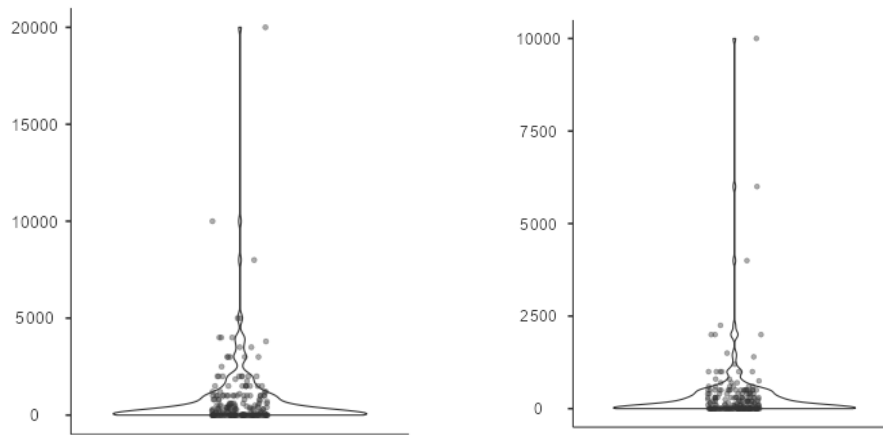
Figure 19: Average spending of producers per year in € on analog (left) and digital (right) synthesizer

Also here zooming into the 90% percentile helps:
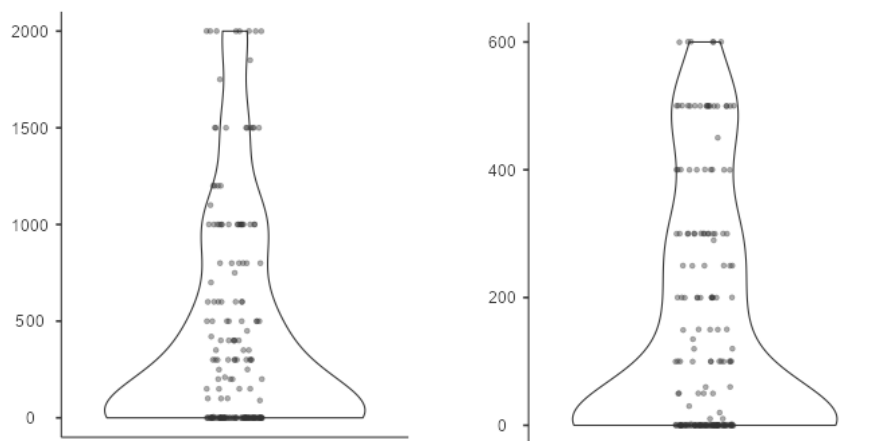
Figure 20: 90%-percentile average spending of producers per year in € on analog (left) and digital (right) synthesizer

Similar to DJs, more money is spent on analog then on digital synthesizers.

The corona pandemic had a different impact on those groups as 52% spend less money on vinyl and 27% spend less on analog synthesizers (Appendix B 1.9). The huge span in spending is also displayed when looking at the amount of owned media:
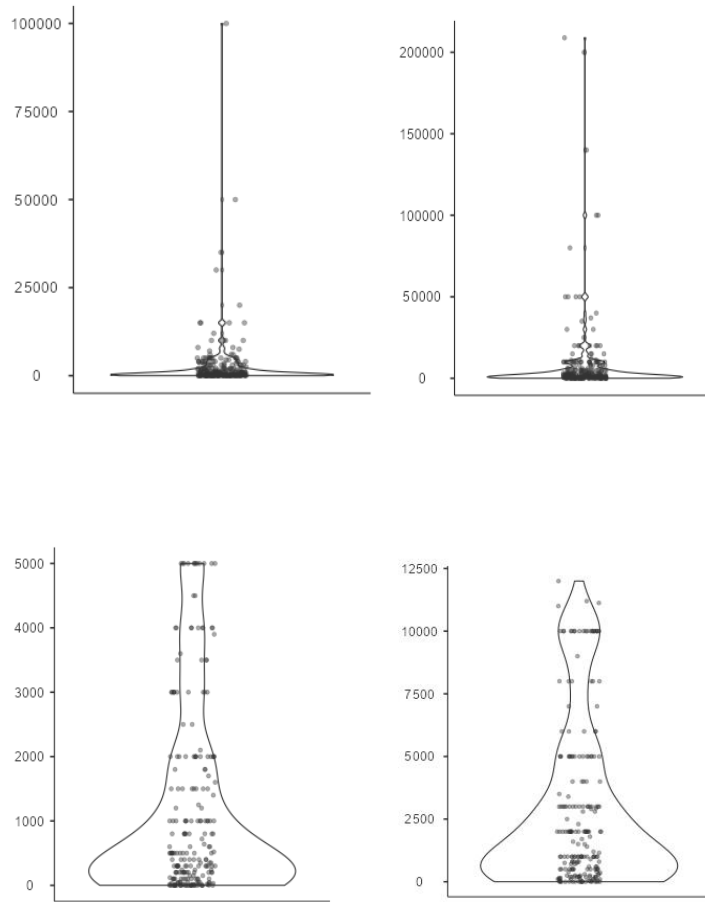
Figure 21: Amount of owned vinyl and files by DJ

Top: total amount, bottom: 90% percentile; left: analog, right: digital

90% of the DJs own 5000 vinyl or less and 12,000 files or less. It has to be mentioned that the numbers are not directly comparable as it was asked for vinyl records which usually feature multiple tracks.This makes it hard to estimate how many tracks this could relate to. Assuming that a standard dance music EP has an average of 3 tracks the number might be quite even.

Synthesizers, on the other hand are directly comparable and provide thefollowing picture:
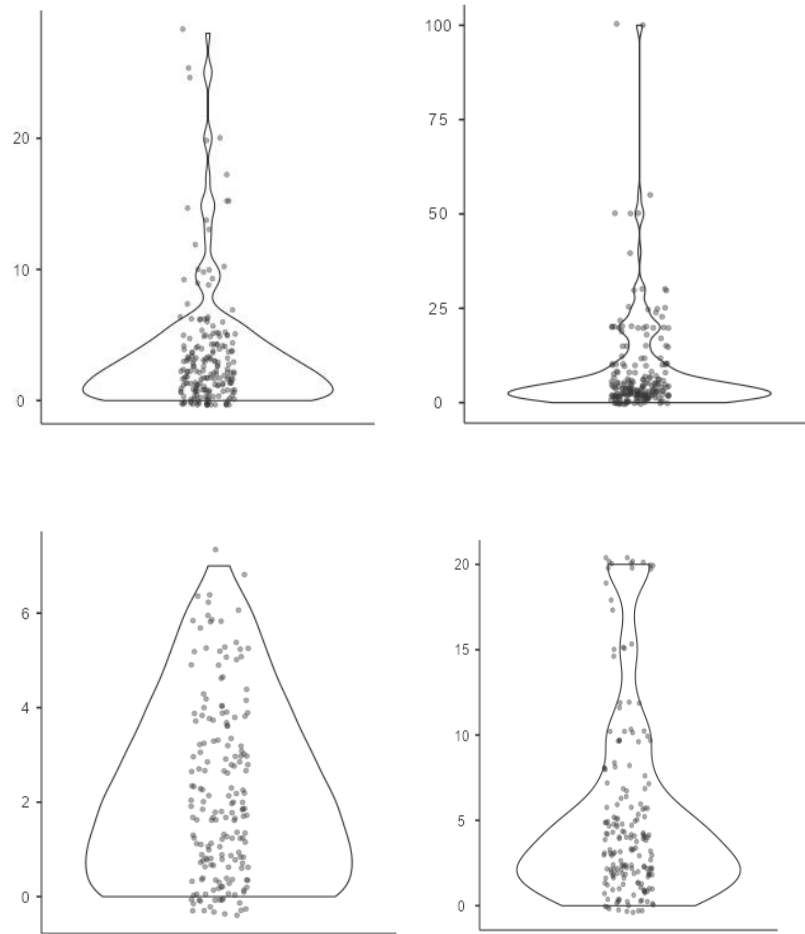
Figure 22: Amount of owned analog and digital synthesizers by producers

Top: total amount, bottom: 90% percentile; left: analog, right: digital

It is obvious that there are more digital synthesizers owned, which can also be plugins which are way cheaper or even for free.

The big span regarding ownership and spending can also be related to the differences of experience as someone how is collecting records for already 30 years and more has for sure a bigger collection as someone who just started. The experience with vinyl was 10.5 years on average and 7.5 years with digital DJ media while producers had 6.9 years of average experience with analog synthesizers and 9.4 years with digital synthesizers.
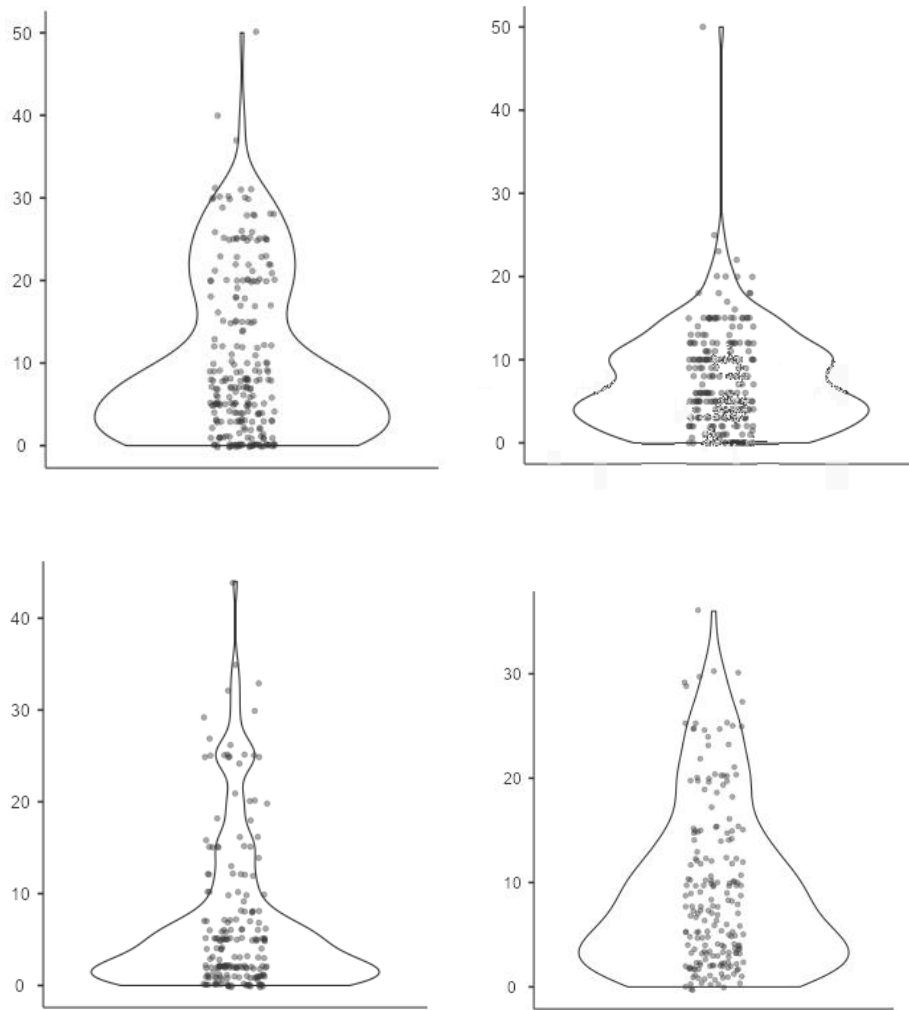
Figure 23: Experience in years:

top: DJ analog(left) and digital(right), bottom producer analog(left) and digital(right)

The most common music styles were Techno (DJs: 85%, Producers: 73.6%), House (71%, 53%) and Electro (59,6%, 49,3%) .

Noticeable similarities between DJs and producers appeared on a couple of questions regarding the motivations of media usage. 96.2% of the DJs and 86.3% of the producers agreed that analog media has a different sound resulting in 62.2% (DJs) and 62.7% (producers) stating that they feel the sound is better. Also, many subjects agreed that they preferred physical interaction when making music (77.9% of the DJs and 89% of producers). 87.2% of the DJs like to collect records while 72.2% of the producers like to collect synthesizers. Similar amount of subjects agreed that digital alternative offer more functions (87.6% of DJs and 86.2% of producers). While 74.8% of the DJs agreed that they like

the social interactions connected with analog media this was only true for 44.5% of the producers (Appendix B 1.4 & 1.5).

5.2 Media use

The usage between digital and analog media was asked for home and live situations. This question was later being used as the dependent/outcome variable in the regression model and is also important to answer RQ2 and RQ3.
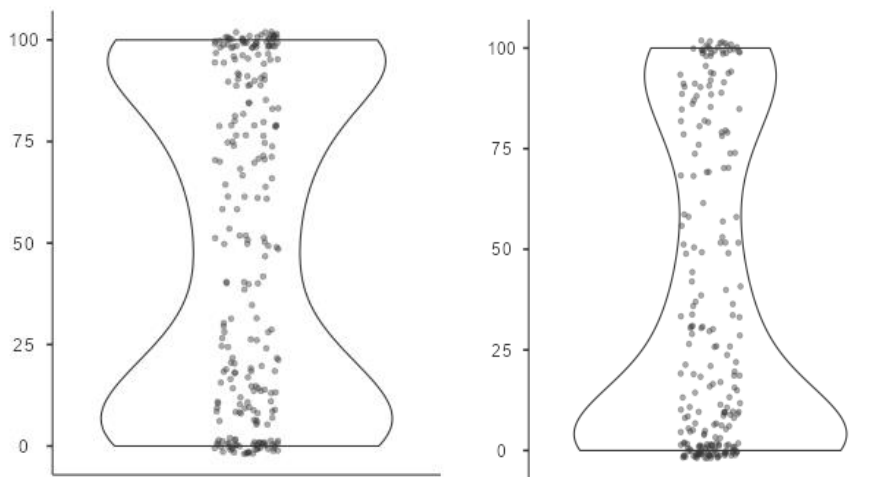
Figure 24: Frequency of responses per digital/analog usage (DJs).

Home (left) and stage (right); 0% means digital only while 100% is analog only

It is obvious that there is an accumulation on the ends of the spectrum, indicating that there exist groups which could be called either analog or digital purist. For DJs at home these seem to be rather equal (digital only 48 / 19,5% and analog only 49 / 19,9%) while this shifts for the live (stage) performances where we see a lot more of digital only (69, 30,3%) than analog (28, 12,3%). The amount of users which use more analog then digital (>50% usage) drops from 47,2% (home) to 33,3% (stage).
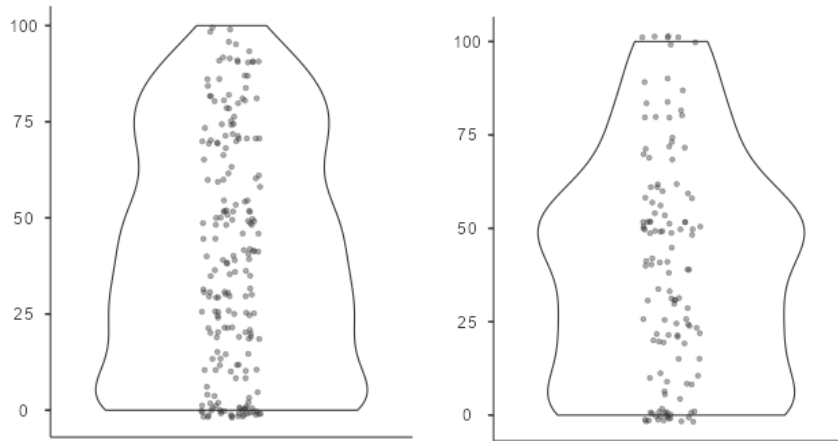
Figure 25: Frequency of responses per digtial / analog usage (producers).

Home (left) and stage (right); 0% means digital only while 100% is analog only

A different picture results from the usage of synthesizers. While there are also extremes for digital only this is not the case anymore for analog only although there is more emphasis on equal setups. The group of digital purists compares to the DJs at home (producers at home: 37 / 18,4%; producers on stage: 23 / 18.5%) while the analog only group is very small in both cases (producers at home: 3, 1,5%; producers on stage: 7, 5,6%). The amount if users who use more analog then digital (>50%) doesn't drop to much between home and stage performance and compares to the amount of DJs on stage (home: 66 / 33% ; stage: 37 / 29.6%) (Appendix B 1.5).

5.3 Data transformation and discretization

The obtained sample underwent some data cleansing and a few transformations. Wrong input for the experience with media was corrected (some subjects entered the year they start instead of the total number of years) and the inputs for countries were adjusted. Missing values for the likert-scale variables were filled with the median so these values can still be used for the model. The metric variables which were being used for the clusters were filled with their mean values when missing. The dependent variable of analog media usage was captured between 0-100% in increments of five. These were transformed into new variables dividing the subjects into groups which would later be used in the ordinal regression model. Initially, there were three different variations of discretization (also 5 and 7 groups) and as shown in chapter 5.5 the best model fit was achieved with three groups:

1. Values: 1-39: mostly digital
2. Values: 40-60: even
3. Values : 61-100 mostly analog

This result in the following distribution (Appendix B3.3):

Use of analog media (vinyl) of DJs

■ DJ Home   ■ DJ Stage

Use of analog media (synthesizer) of producers

■ Producer Home   ■ Producer Stage
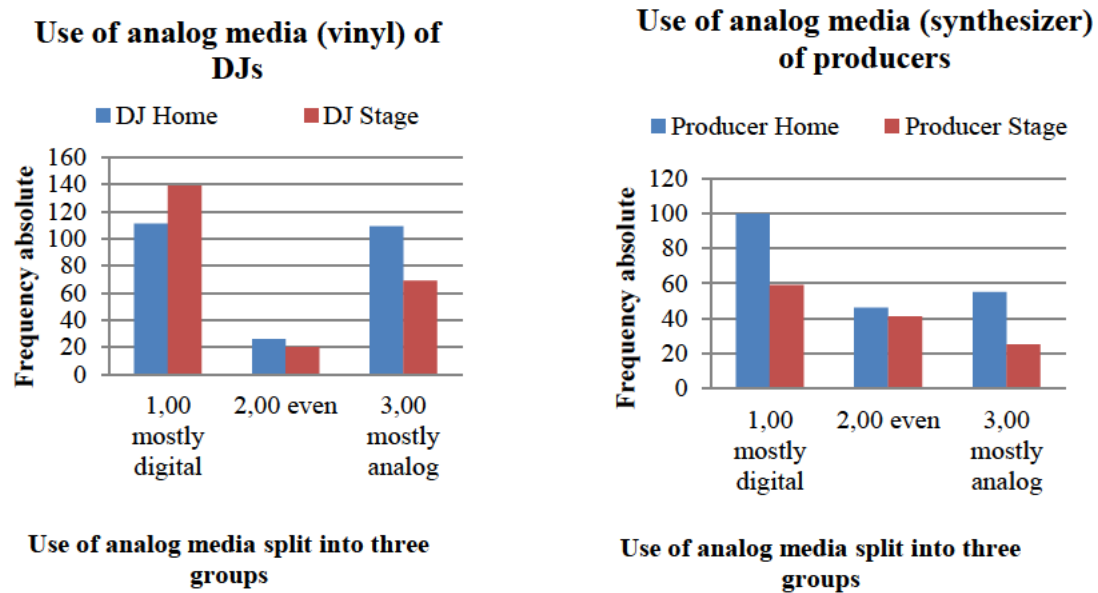
Figure 26: Distribution of media usage with three groups

As the user groups of home and stage usage are not necessarily of equal size (as not everyone performances on stage) it helps to examine the relative proportions of these groups:
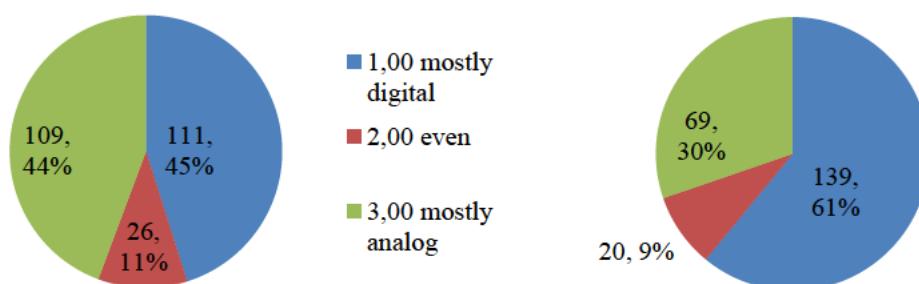
Figure 27: Relative distribution of media usage of DJs, home (left) and stage (right)

For the DJs it confirms similar sizes between digital and analog use at home, while this shifts towards digital in live situations. The *even* group stays more or less stable.

The difference of the group size between home and stage situations is more profound for producers:
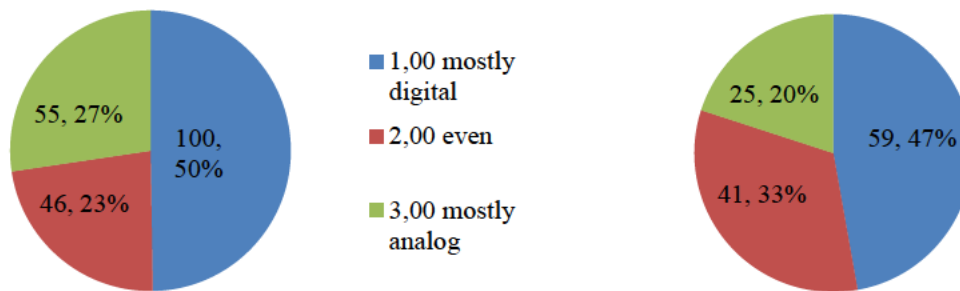
Figure 28: Relative distribution of media usage of producers, home (left) and stage (right)

Here the relative size of *mostly digital* stays more or less the same while the shift between home and stage happens from *mostly analog* to *even*.

Finally the spending of analog and digital were added into one variable (*purchase power)* for later use as control variable. To determine who completed the survey the data was filtered with the help of the last page which was set to 11.

5.4 Clustering

Only relevant for the producers is the question on how a definition of an analog synthesizer can be defined in order to answer research question RQ1. Therefore, the participants were given a list of components or features and were asked which of them they would *not* consider to be part of an *analog synthesizer*. More precisely, they were asked:

> *There are plenty of different synthesizers available which claim to be analog. They come with different features and architectures. From your perspective, which digital components should a Synthesizer not have in order to be still considered as analog ?*

Several clustering methods were tried and the two-step clustering produced the best outcome. The number of clusters was determined as a fit between equal sized clusters with a decent cluster quality (silhouette measure of cohesion and separation > 0.5). This reveled the following pattern:
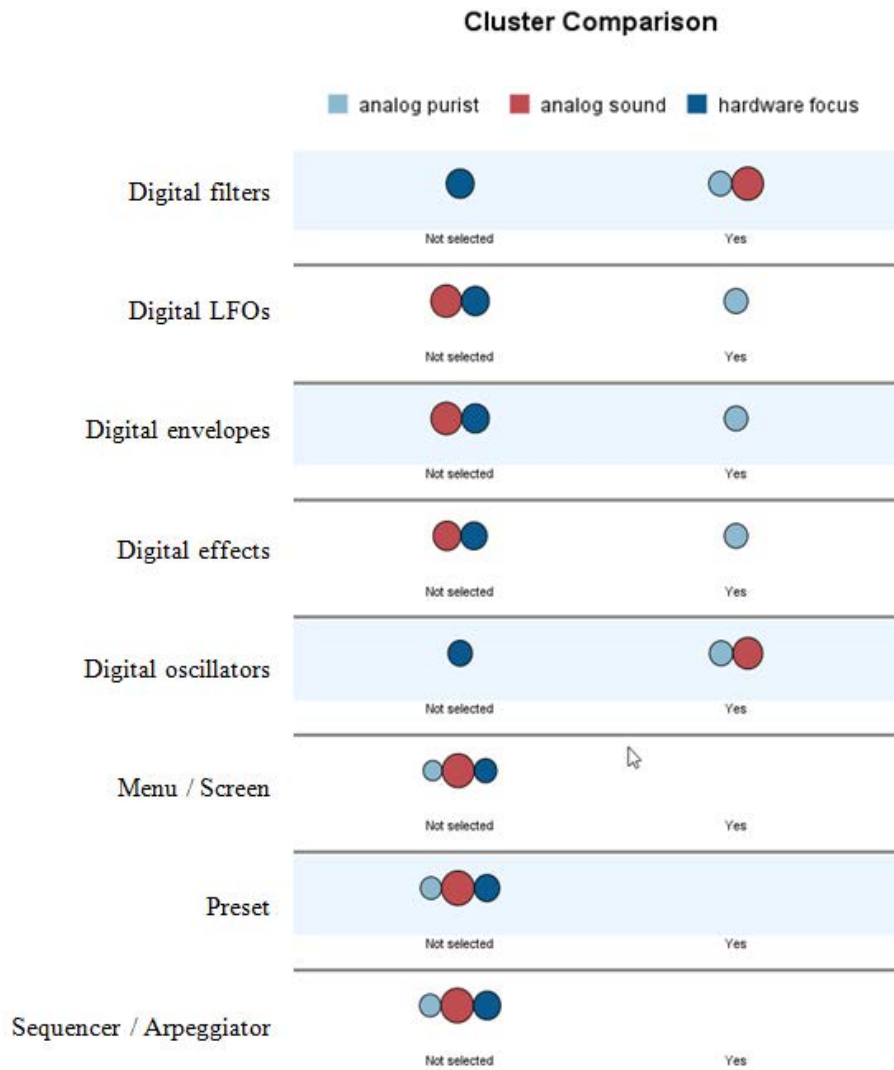
Figure 29: Selected components and clusters

Cluster predictors sorted by importance. Bubbles represent the different cluster. Bubble size based on amount of responses

As seen above this resulted in three groups of possible definitions, dependent on three groups of categories (Appendix B2.2):

- Menus, presets, arpeggiator and sequencer are not important
- Digital oscillators & digital effects have a medium impact
- Filter, LFOs & envelopes are most important for the definition

With the help of these categories the clusters of similar size were found:

64, 32%

46, 23%

91, 45%

■ 1: 'hardware focus'
■ 2: 'analog sound'
■ 3: 'analog purist'
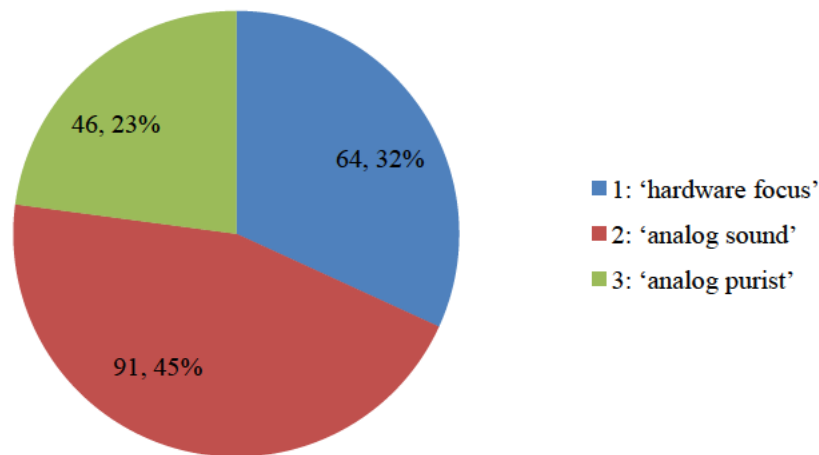
Figure 30: Producer cluster based on components

The resulting groups could be described as:

1. 'hardware focus': no clear preference between components which should be excluded, physicality seems to be more important
2. 'analog sound' : device should not have any digital oscillators or filters
3. 'analog purist' : device should not have any digital oscillators, filters, envelopes or LFOs

In order to further understand these user groups, some of the socio-demographic metrics collected were used for an analysis of variances. The used variables are total purchasing power, age, the experience with analog and digital as well as the ownership of analog and digital synthesizers.

As none of these variables has passed a test of normality (Appendix B2.4), the Kruskal-Wallis-Test (H-Test) was used in order to identify significant differences between the groups of analog definition.

The test revealed significant effect for all variables except the ownership of digital synthesizers. In order to determine details, it was followed up with Post-hoc-Tests (Dunn-Bonferroni-Tests) which allowed a pairwise comparison of the different groups with the following results:

		Effect size of pairwise comparisons of groups		
	Sig.	1 & 2	1 & 3	2 & 3
Total purchasing power	0.005		0.16	0.28
Age	0.047	0.2		
Amount of analog synthesizers owned	0.009			0.23
Amount of digital synths owned	0.155			
Years of experience with analog synthesizers	0.007	0.24		
Years of experience with digital synthesizers	0.001	0.30		

Note: Groups: 1: 'hardware focus', 2: 'analog sound', 3: 'analog purist'

The result of Dunn-Bonferroni-Tests was used to determine the effect sizes, based on the formula:

$$r = \left| \frac{z}{\sqrt{n}} \right|$$

r= effect size, z = Std. Test Statistic, N = combined group size

Although there are some effects none of them is really strong (> 0.5), according to (Cohen 1992). Still, the following statements can be made (Appendix B2.4)

- Spending:
  - significant difference between 'analog sound' & 'analog purist' indicating that group 'analog sound' spends more money
  - significant difference between 'hardware focus' & 'analog purist' indicating that group 'hardware focus' spends more money

- Age: significant difference between 'analog sound' & 'hardware focus' indicating that members of group 'hardware focus' are older
- Ownership of analog synthesizers: significant difference between 'analog sound' & 'analog purist' indicating that group 'analog sound' owns more synthesizers
- Experience with analog: significant difference between 'analog sound' & 'hardware focus' indicating that members of group 'analog sound' have more experience with analog synthesizers
- Experience with digital: significant difference between 'analog sound' & 'hardware focus' indicating that members of group 'analog sound' have more experience with digital synthesizers

This subjective definition was then being used to answer the other questions of the survey.

In order to answer some of the hypotheses *H2.1b prefer touch*, *H2.2b requires skill* and *H2.b more fun* as part of RQ2b and RQ3b it was necessary to group the subjects based of different questions. The two-step-clustering-method was used (similar to analog definition above) to find similar groups between DJs and producers based on their experience with analog and digital media. For both groups 3 clusters in similar size were found (Appendix B2.1):

Result for DJs:
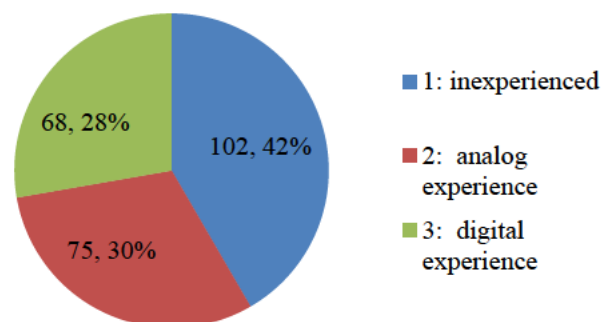
Figure 31: DJ cluster based on analog and digital experience

The clusters can be interpreted like:

- Inexperienced: low level of experience for both analog (mean 4.1 years) and digital (mean 3.4 y)
- Analog experience: high level of analog experience (mean 23.2 y) and medium level of digital experience (mean 8.8 y)
- Digital experience: low level of analog experience (mean 5.5 y) and higher level of digital experience (mean 11.5 y)

A visual representation of the groups further shows the separation the groups:
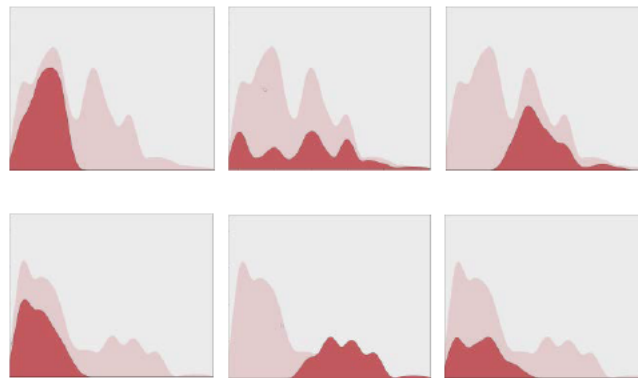
Figure 32: Cluster distribution DJ

Top Row: experience with digital in years, Bottom row: experience with analog in years

Left to right: Inexperienced, Analog experience, Digital experience

Results for Producers:
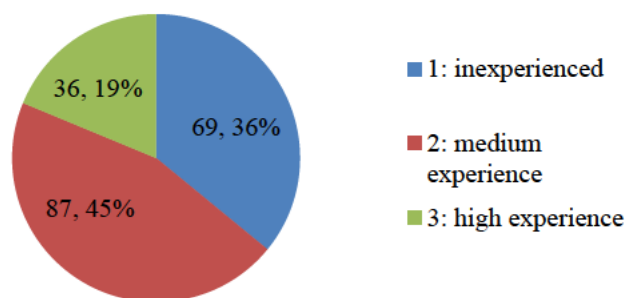
Figure 33: Producer cluster based on analog and digital experience

While also having an *Inexperienced* cluster to begin with, the other groups look slightly different:

- Inexperienced: low level of experience for both analog (mean 1.4 years) and digital (mean 2.5 y)
- Medium experience: medium level of experience for analog (mean 5.1 years) and with emphasis on digital (mean 10.3 y)
- High experience: high level of experience for both analog (mean 20.6 years) and digital (mean 20.9 y)

This is also apparent in the visual representation:
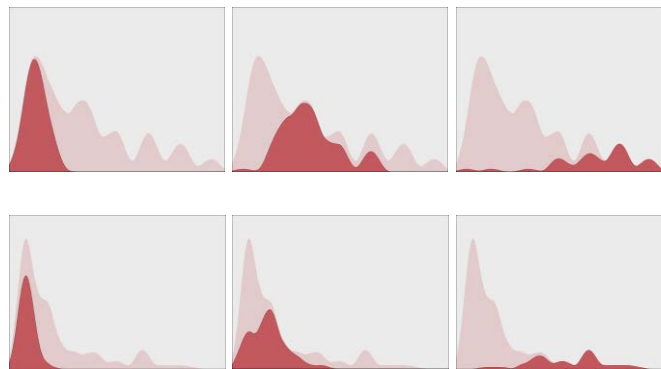
Figure 34: Cluster distribution producers

Top Row: experience with digital in years, Bottom row: experience with analog in years

Left to right: Inexperienced, Medium experience, High experience

5.5 Ordinal regression

It was obvious from the media usage that the dependent variable shows no normal distribution (Figure 24 & 25) and as the values are also limited between 0 and 100% the hypotheses were tested with an ordinal logistic regression model. The dependent variable was the analog media usage, measured in % (resulting in different groups, chapter 5.2) and distinguished between setting at home or on stage. The independent variables are the different motivations which are the result of the hypotheses. A detailed mapping of the hypotheses to the questions and the used coding can be seen in Appendix B3.4. In order to remove the effect of age, gender or the total spending, these were added to the model as control variables.

As an ordinal regression falls into the class of generalized linear models with ordinal response outcomes, several link functions are available for use which has an impact on the model fit, based on the distribution of the predictor variable (Smith et al. 2019). Therefore, all functions were compared in order to determine the best for the desired model. To do this, the predictor variable with three groups was the basis in order to have most robust groups (see chapter 5.2). The *Complementary Log-log* had the best combined performance across all models (from a total of 20 models), based on the model fit parameter *-2 Log Likelihood, Goodness- of Fit by Pearson* and the *Test of parallel lines* (Appendix B3.1). It has to be mentioned that the *Test of parallel lines* (tests the proportional odds assumption) failed for the predictor of media usage producers on stage, which will be discussed later but it is already clear that the right choice of a model has to be some kind of compromise. As a next step the right number of groups within the predictor variable was chosen, which was based on the same parameters as for the link function. Out of 12 models the one with 3 groups performed the best with the same limitation of failing the *Test of parallel lines* for usage producers on stage (Appendix B3.2).

Given the results of the comparison between different groups and link functions, the models were chosen based on the following model information:

Table 2

Model fit of ordinal regressions

depended Variable	Model Fitting Information		Goodness- of Fit		Pseudo R Square	Test of parallel lines
	-2 Log Likelihood	Sig	Pearson	Deviance	Nagelkerke	Sig
DJ HOME	244.56	0	0.027	1	0.673	0.753
DJ STAGE	121.35	0	0	1	0.833	1
PROD HOME	296.27	0	0.684	0.989	0.446	0.942
PROD STAGE	163.70	0	0.551	0.904	0.569	0.012
DJ HOME Interaction	438.85	0	0.063	1	1	1
DJ STAGE Interaction	364.40	0	1	1	1	1
PROD HOME Interaction	372.20	0	0.501	0.406	0.745	0.709
PROD STAGE Interaction	234.67	0	0.976	0.891	0.8	1

Note: all models with Complementary Log-log link function are significant. All except producer stage pass the test of parallel lines (Appendix B3.3)

Based on these models, an ordinal regression was done for each of the four predictor variables (Appendix B3.5) and can be summarized like this:

Figure 35: Ordinal regression main effects

Parameter estimates and their 95% confidence intervals; left DJ, right Producer (without control variables)

Significant predictors don't include zero within their confidence intervals

The results can be grouped into different groups which will be interpreted in the discussion:

- Significant for all: Prefer to touch & digital opportunities confirming H2.1 & H4.3
    - Stronger effect for producers regarding H2.1
    - Stronger effect for stage regarding H4.3 for DJs and producers
- Significant for three groups: Social interaction (DJ home & stage, producer stage) confirming H3.4 only for DJs as for producers the effect has different direction
- Significant for two groups:
    - Analog expensive (producer home & stage) confirming H3.3
    - Creativity through limits (DJ & producers home) confirming H4.2
    - Own past (DJ stage & producers home) confirming H5.2
    - Infrastructure (DJs home & stage, producer stage) confirming H6.2
- Significant for one group:
    - Sound different: DJ stage confirming H1.1
    - More Value: producer stage confirming H3.2
    - Past times: producer stage confirming H5.1
    - Acts admire: producer stage confirming H6.1
    - Age: producer home

As seen, only 2 hypotheses can be confirmed across in all models. Partly another eight can be confirmed. All other hypotheses can be rejected, at least for the models without any interaction effects, which are being tested in the next section.

The details and exact effect sizes can be seen in the direct output of the regression:

Table 3

Results of ordinal regression (main effects)

Hypothesis code	DJ home		DJ stage		producer home		producer stage	
	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.
H1.1 different sound	-0.216	0.104	-0.364	0.01	0.158	0.136	0.061	0.632
H1.2 better sound	-0.005	0.957	-0.026	0.784	-0.198	0.072	-0.043	0.75
H2.1 prefer touch	0.233	**0.022**	0.26	**0.014**	0.4	**0.001**	0.351	**0.01**
H2.2 requires skill	-0.093	0.29	-0.155	0.085	0.149	0.052	0.182	0.056
H2.3 more fun	0.018	0.855	0.14	0.171	0.129	0.232	0.078	0.561
H3.1 collecting	0.088	0.41	-0.086	0.447	0.009	0.921	0.037	0.765
H3.2 more value	0.1	0.244	0.099	0.269	-0.023	0.794	0.336	**0.007**
H3.3 analog too expensive	0.142	0.113	0.023	0.791	-0.23	**0.014**	-0.44	**0.001**
H3.4 social interaction	0.321	**0.001**	0.267	**0.006**	-0.165	0.058	-0.262	**0.026**
H4.1 no screen	0.105	0.185	0.034	0.677	0.105	0.168	-0.008	0.939
H4.2 creative limits	0.187	**0.049**	0.07	0.456	0.207	**0.03**	0.158	0.208
H4.3 digital functionality	-0.296	**0.01**	-0.398	**0**	-0.244	**0.013**	-0.323	**0.009**
H5.1 Retromania	-0.006	0.952	0.028	0.762	0.11	0.263	0.311	**0.015**
H5.2 nostalgia	0.131	0.126	0.067	0.443	-0.018	0.85	0.011	0.931
H5.3 personal history	0.061	0.427	0.187	**0.014**	0.242	**0.035**	-0.117	0.395
H6.1 role models	-0.111	0.166	-0.14	0.096	-0.159	0.057	-0.401	0.002
H6.2 infrastructure	-0.3	**0**	-0.188	**0.027**	-0.023	0.796	0.22	0.079
Purchase power	0	0.674	0.001	0.441	0	0.138	0	0.12
Gender	-0.643	0.163	-0.13	0.736	0.175	0.797	-1.557	0.086
Age	-0.003	0.857	-0.007	0.664	-0.029	**0.049**	0.025	0.184

Note: summary parameter estimates & significance (including control variables). Significant results in bold, mapping

between coding and hypotheses to be Appendix B3.4 (Link function: Complementary Log-log.)

5.6 Interaction effects

For the hypothesis in the area haptic and performance, it was assumed that experience with the medium has an influence on the in order to become (more) relevant for specific motivations. Hence, H2.1 prefer touch, H2.2 requires skill and H2.3 more fun were extended by an additional hypothesis each (H2.1b,H2.2b & H2.3b). Therefore, the clusters (see chapter 5.4) based on analog and digital experiences were created which will be used as interaction terms within the ordinal regression model with the inexperienced group as a reference. This allows interpreting the results in two ways:

1. Examine the main effects for the reference group and look for the difference to the model without interaction terms
2. Examine the interaction terms for the specific groups and predictor

As seen in table 2 the models even increased in model quality, regarding Pearson (Goodness of Fit) and Nagelkerke (Pseudo-R Square).

Similar to the model with the main effects a visual representation of the results looks like:
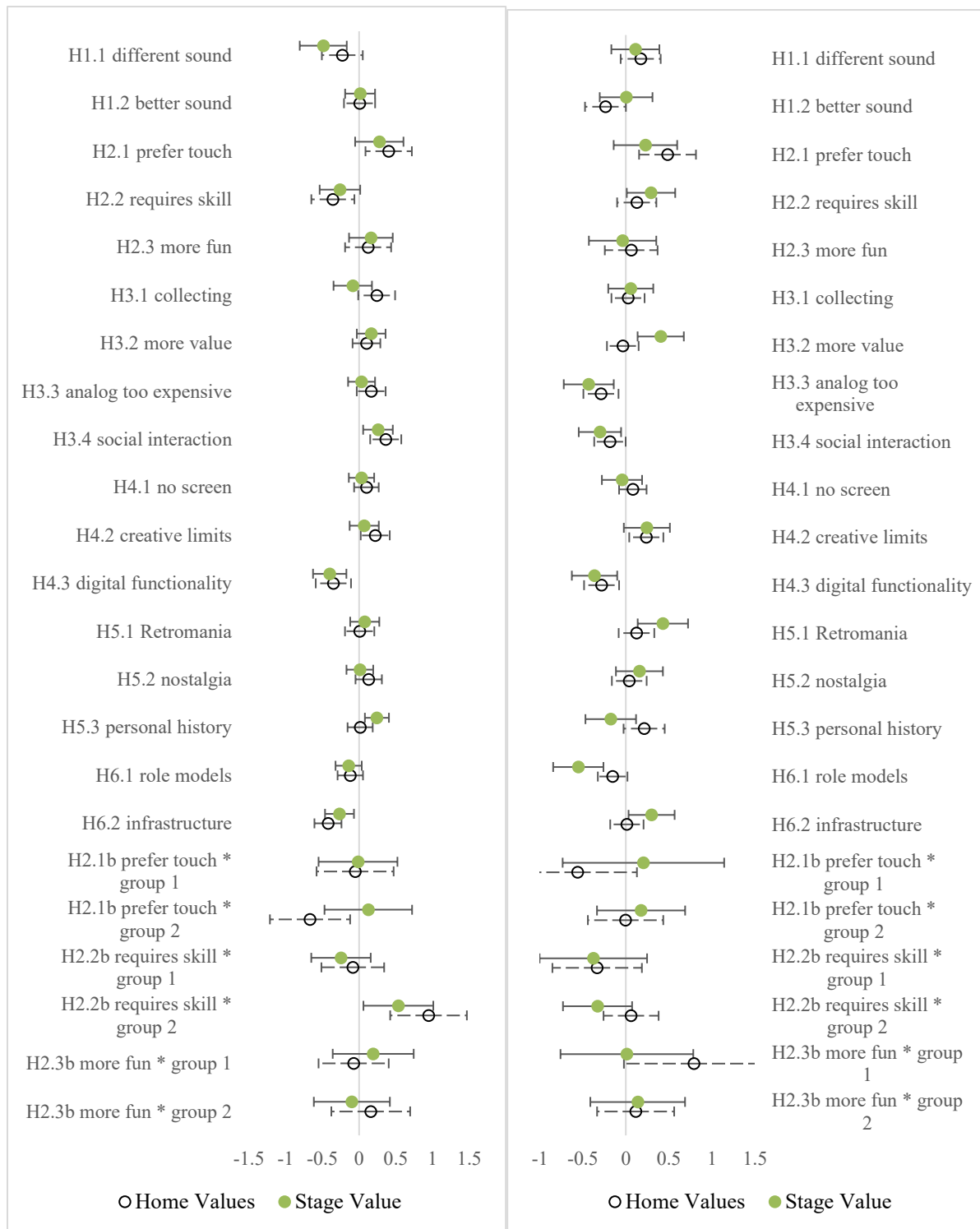
Figure 36: Ordinal regression including interaction terms

Parameter estimates and their 95% confidence intervals; left DJ, right Producer (without control variables)

Significant predictors don't include zero within their confidence intervals

Cluster groups DJ: 1 = analog experience, 2 = digital experience;

Producers: 1 = a lot of experience, 2 = medium experience

The reference group for both areas is the inexperienced cluster and already shows the following results compared to the model without any interactions:

- H2.1b prefer touch: now only significant for home use (DJs and producers; still stronger for producers)
- H2.2b requires skill: requires skill becomes significant for DJs at home (strong negative effect) and producer at stage
- H5.3 personal history not significant anymore for producers
- Rest stays the same

The interaction effects are based on the difference towards the other groups. These clusters differ slightly between producers and DJs in their structure and it seems that only the DJs are effect by these clusters, at least for these hypotheses:

- H2.1b prefer touch: negative effect for the digital experienced user (home)
- H2.2b requires skill: positive effect for the digital experienced user (home and stage while stronger for home)

Again, the details can be taken from the following table:

Table 4

Results of ordinal regression (including interaction effects)

	DJ Home		DJ Stage		Producer home		Producer stage	
	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.
Hypothese code	0a	.	0a	.	0a	.	0a	.
H1.1 different sound	-0.229	0.107	-0.488	**0.003**	0.173	0.146	0.111	0.435
H1.2 better sound	0.006	0.953	0.014	0.896	-0.236	0.051	0.004	0.982
H2.1 prefer touch	0.403	**0.012**	0.275	0.102	0.484	**0.004**	0.228	0.227
H2.2 requires skill	-0.357	**0.017**	-0.261	0.064	0.127	0.276	0.293	**0.042**
H2.3 more fun	0.122	0.445	0.161	0.29	0.062	0.689	-0.038	0.85
H3.1 collecting	0.239	0.062	-0.087	0.516	0.025	0.795	0.058	0.667
H3.2 more value	0.1	0.299	0.165	0.099	-0.035	0.71	0.405	**0.003**
H3.3 analog too expensive	0.165	0.1	0.033	0.722	-0.289	**0.006**	-0.431	**0.004**
H4.1 no screen	0.099	0.247	0.032	0.714	0.082	0.317	-0.045	0.708
H4.3 digital functionality	-0.35	**0.004**	-0.4	**0.001**	-0.281	**0.007**	-0.364	**0.007**
H4.2 creative limits	0.219	**0.029**	0.069	0.493	0.238	**0.018**	0.244	0.074
H5.1 Retromania	0.007	0.943	0.077	0.446	0.124	0.241	0.431	**0.004**
H5.2 nostalgia	0.131	0.154	0.01	0.916	0.04	0.698	0.158	0.257

	DJ Home		DJ Stage		Producer home		Producer stage	
	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.
H5.3 personal history	0.014	0.874	0.242	**0.004**	0.213	0.081	-0.175	0.242
H6.1 role models	-0.12	0.174	-0.142	0.119	-0.153	0.082	-0.552	**0**
H6.2 infrastructure	-0.424	**0**	-0.267	**0.008**	0.012	0.902	0.299	**0.028**
H3.4 social interaction	0.362	**0.001**	0.257	**0.013**	-0.184	**0.047**	-0.301	**0.017**
Purchase power	0	0.654	0.001	0.523	9.78E-05	0.218	0	0.114
Gender	-0.817	0.099	-0.22	0.587	0.204	0.778	-2.646	**0.041**
Age	-0.027	0.261	-0.018	0.421	-0.036	0.057	0.031	0.251
1 * H2.1 prefer touch	-0.055	0.838	-0.015	0.956	-0.562	0.111	0.204	0.669
2 * H2.1 prefer touch	-0.668	**0.017**	0.125	0.68	-0.003	0.989	0.177	0.498
3 * H2.1 prefer touch	0a	.	0a	.	0a	.	0a	.
1 * H2.2 requires skill	-0.086	0.692	-0.247	0.232	-0.333	0.21	-0.378	0.236
2 * H2.2 requires skill	0.945	**0**	0.535	**0.028**	0.061	0.708	-0.328	0.109
3 * H2.2 requires skill	0a	.	0a	.	0a	.	0a	.
1 * H2.3 more fun	-0.074	0.76	0.192	0.495	0.79	0.057	0.012	0.975
2 * H2.3 more fun	0.159	0.562	-0.099	0.709	0.114	0.617	0.138	0.623
3 * H2.3 more fun	0a	.	0a	.	0a	.	0a	.

Note: summary parameter estimates & significance (including control variables). Significant results in bold, mapping between coding and hypotheses to be Appendix B3.4 (Link function: Complementary Log-log.)

Cluster DJ: 1 analog experience, 2 digital experience, 3 less experience

Cluster producers: 1 a lot of experience, 2 mid experience, 3 low experience

5.7 Discussion and interpretation of test results

Before looking at the research questions, the result of the regression and the associated hypotheses, it is worth looking into the characteristics of the sample (chapter 5.1). The majority of participants identify themselves as DJs and producers at the same time while most of them can be considered as amateurs ('*with some public gigs, not financially dependent'*). Both groups unite that they usually possess more digital media while they spent more money on analog media on average. It is also worth noticing the high level of agreements of the statements across all user groups around the topics sound, haptic interaction and collecting material while not all of them have apparently an influence on the choice of the preferred medium. While the participants come from 29 different countries 66% come from Germany so it can be seen in context of the German scene.

In order to examine the research questions RQ2-RQ4 the results of the individual hypotheses need to be interpreted first. The test of the majority of the hypotheses using the ordinal regression revealed two very strong predictors which are true across all user groups:

- H2.1 prefer touch: positive parameter estimates indicate that users who like to physically interact with gear are more likely to use analog media. This effect is stronger for producers.
- H4.3 digital functionality: negative parameter estimates indicate that the potential of digital devices is an important factor for users and drive them into using them. This effect is stronger in live situations.

There was only one predictor which had a significant effect on three groups:

- H6.2 infrastructure: while this has a positive impact on DJs (more for home usage), it is the opposite for live-acts, which indicates that users who like to interact with other are more likely to perform with a digital setup. This could be because digital live setups are less complex, require less space and make it easier to cooperate.

A set of four predictors were important for half of the groups:

- H3.3 analog too expensive: only relevant for producers. The negative parameter indicates the price is only relevant for producers, and they are more likely to use digital devices because of this while this is way more important for live setups.
- H4.2 creative limits: the positive parameters indicate that this is only true for DJs and producers at home with similar effects. This could be because creativity is more important in a home environment as in a live situation which is more about performance.
- H5.3 personal history: the positive parameters indicate that nostalgia is relevant for performing DJs and even more for producers at home
- H6.2 infrastructure: the negative parameters indicates only DJs are dependent on infrastructure and that the lack it drives people into digital media, especially home DJs.

Additionally there are a number of single predictors which seem to be only relevant for specific groups:

- H1.1 different sound: the negative parameter indicates DJs on stage think that there are differences and are thus more likely to play digitally on stage (which indicates that they think vinyl sounds worse in a club environment)
- H3.2 more value: relevant for live acts which could be due to the fact that they need reliable and high-quality gear on stage. The positive parameter indicates that they are willing to spend more money on equipment for a live setup.

- H5.1 Retromania: positive relevant for live acts which indicates they that user with nostalgia are more likely to do it "the old way"
- H6.1 role models: Live acts are more likely to go digital when admiring acts, indicating they these acts also play digitally
- Age: negative parameters indicate that older people are more likely to use analog gear when producing at home

Regarding the clusters (chapter 5.4) based on media experience it was useful that for both DJs and producers a group with little experience could be used a reference group for the moderation analysis. The other groups for DJs are more focused around vinyl / digital which is in line with the usage behavior observed. This reflects also on the other cluster groups for producers as there doesn't seem to be such a big separation of analog / digital resulting in clusters around general experience with both while it is apparent that there is more digital experience in general which is due to the fact, that the majority of producers start with computer based setups, as those are usually already available. With the help of these clusters, the regression model was enhanced by interactions effects based on analog and digital experience of the users. This resulted in an improved model fit and showed the following for inexperienced users:

- H2.1b prefer touch (interaction) only significant for home use: for inexperienced this might not be so important in live situation because they are less confident.
- H2.2b requires skill (interaction) becomes significant for DJ Home (negative effect) and producer on stage:
    - For home DJ: as very strong negative effect: the skill level might be a barrier
    - For producers on stage: the challenge might be motivating
- H5.3 personal history for producers is not significant anymore which is obvious if only little experience is available

The comparison to more experienced users was only relevant for DJs and the following hypotheses:

- H2.1b prefer touch (interaction): negative effect for the digital experienced user: digital experienced user are likely to have digital devices at home which they can also touch, so no need for analog
- H2.2b requires skill (interaction): positive effect for the digital experienced user: indicating that digital experienced user can appreciate the difference and might be open to use more analog

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All these results can be used to answer the research questions and can be summed up like this:

Table 5

Summary of all hypotheses and their results

Hypotheses	DJs: RQ 2b		Producers: RQ 3b	
	Home	Stage	Home	Stage
H1.1 different sound		blue		
H1.2 better sound				
H2.1 prefer touch	green	green	green	green
H2.1b prefer touch (interaction)		yellow		yellow
H2.2 requires skill				
H2.2b requires skill (interaction)	yellow			yellow
H2.3 more fun				
H2.b more fun (interaction)				
H3.1 collecting				
H3.2 more value				green
H3.3 analog too expensive			green	green
H3.4 social interaction	green			blue
H4.1 no screen				
H4.2 creative limits	green		green	
H4.3 digital functionality	green	green	green	green
H5.1 Retromania			green	green
H5.2 nostalgia				
H5.3 personal history		green	yellow	
H6.1 role models				
H6.2 infrastructure	green			yellow

- green = *significant main effect according to the hypothesis*
- blue = *significant main effect but opposite than assumed in hypothesis*
- yellow = *significant interaction effect*

Based on these results it is possible to answer the research questions. Starting with the term *analog* as it was of high importance in the course of the survey, it was closer examined from a producer's perspective:

RQ1: How is the term analog understood in the context of synthesizers from the perspective of a producer within the techno scene?

The variety of products on the market and flexible use of the term *analog* also results in different perspectives on what an analog synthesizer has to consist of. With the help of a cluster analysis, different groups and relevant predictors were identified. It might be obvious that elements which are digital by definition like a screen or preset storage are not as important as components which affect the sound (oscillators, filter, effects) or have at least influence on the sound like LFOs or envelopes.

It seems like there are three different groups of users with their own definitions. First, roughly one third of them actually don't seem to have a clear preference regarding the use analog components, indicating that for them it is only important to have a hardware box to interact with. The biggest group (45,3%) want to have at least an analog sound generation (filter and oscillators). Lastly, the smallest group could be considered as *purists* who require also the other analog components to be analog.

RQ1b: Does a different understanding of the term analog also result in different user groups with distinctive characteristics?

The analysis of variances revealed that the biggest group also spendt more money per year than the others (mean = €1636, sd = 3573 vs mean = €861, sd = 1000 ['hardware focus'] vs mean = €861, sd = 3573 ['analog purist']). They also have more experience and own more devices which probably makes them the most attractive target group which is already present in the current market as most new synthesizers fall into this category.

RQ2: How much is vinyl being used by DJs of the Techno scene and does the usage differ between home and stage performances?

For the DJs, we see a clear tendency towards extremes; many DJ are on one side of the spectrum. While at home the groups are quite even, in live situation the digital-only group is way bigger (61% vs 30,3%), although the 'even' groups stays relatively the same. This is probably due to different factors. Playing digitally in clubs can be favorable due to the (missing) infrastructure in the clubs. At the same time, travelling without vinyl and having access to a lot more tracks is way more convenient in live situations. Also, DJs usually don't have to spent so much time with beat matching as this is done by the digital tools or at least assisted by them which makes it way easier.

RQ2b: What are the reasons and motives for the usage of vinyl by DJs of the Techno scene and do they differ between home and stage performances?

As the need to touch (H2.1) & and digital opportunities (H4.2) are true for all categories, this obviously also applies also to the DJ domain. Specific to vinyl infrastructure (H6.2) and social interaction (H3.4) are relevant for home and stage usage, proofing the importance of local standards (infrastructure) and social interaction in scene specific places like records stores.

While the performing DJs are the only ones where sound plays a role the hypothesis (H1.1) cannot be confirmed as the effect is the opposite (negative) which means that the sound quality is actually a reason to not play vinyl. Additionally, personal experience (H5.2) seems to be only relevant for stage use while the limits on analog media (H4.3) are only relevant for home use.

Adding personal experience shows that the need to touch (H2.1) seems to be only important to experienced users in stage situations as less experiences user are probably less confident. Also, the required skill is getting acknowledged even by users with digital experience.

RQ3: How much are analog synthesizers being used by producers of the Techno scene and does the usage differ between home and stage performances?

The groups of producers are way more balanced than the DJs. This probably because there exist way more different setups, as those are highly individual and less influenced by industry standards or a given club infrastructure. The group *mostly digital* stays relatively the same for home (50%) and stage (47%) situations but the *even* group is bigger in live situations (33% vs 23%) which in return results in an overweight of *mostly digital* setups (47%) over *mostly analog* setups (20%). This can be explained as for stage performance there are usually limitations regarding space, complexity of the setup and playability. Digital devices offer more functionality and flexibility (as proved with H4.3).

RQ3b: What are the reasons and motives for the usage of analog synthesizers by the producers of the Techno scene and do they differ between home and stage performances?

Also here H2.1 & H4.3 apply. The only additional similarity seems to be that the price of analog hardware (H3.3) is an important factor and pushes user to use digital instead.

Exclusive to home use are the factors of own experience (H5.2) and the limits of analog hardware (H4.3). The live use, on the other hand relies on the notion that analog hardware is more valuable

(H3.2) and Retromania (H5.1). The effects of social interaction (H3.4) and role models (H6.1) are significant but also with negative effect and thus the hypotheses need to be rejected.

Also here, less experienced users don't feel the need to touch (H2.1) while it seems that the notion of required skill seems to push them to use more analog. At the same time, infrastructure (H6.2) becomes important for this group, and personal history (H5.3) doesn't play a role.

RQ4: What are the similarities between producers and DJs of the Techno scene regarding the reasons for and amount of usage of analog media?

Based on the prior to research questions a comparison between producers and DJs creates additional insights.

Both groups unite that in live situations digital tools become more favorable but the producers seem to have much more balanced setup which consist of both medium while DJs tend to focus more on extremes of vinyl / digital only.

H2.1 & H4.2 are the most important factors across all areas. For both areas the limits of the analog world (H4.3) are only relevant for home use which could be due the fact that at home, users might not want to be distracted by digital devices with their screens. The usage which is based on the own history is relevant for DJs on stage and producers at home which in return means the DJs at home and live producers are more likely to react to current developments.

Economic factors as in perceived value of the equipment or the required resources seem to be only relevant for producers. This could be as a single record / track is usually not as expensive as a hardware synthesizer which usually requires quite an investment. For DJs, infrastructure and social interactions seem to have a bigger influence as these activities are more based on standards and exchange.

Adding personal experience reveals that H2.1 seems to be only relevant for experienced users. The notion of skill becomes relevant in that context although with different effects (negative of DJs, positive for producers).

It is also possible to draw conclusions from the effects which are not significant:

In all groups, the majority agreed that the sound of analog media is different (H1.1) and that they collect those (H3.1). This might explain why these don't result in significant effects as many users share these attitudes while it doesn't seem to have a (strong) influence of the media usage. (Appendix B 1.4 and 1.5).

6. Conclusion, limitations and outlook

If *the medium is the message* and an *extension* of us, it (inter)acts in a multitude of ways and is as diverse as humans themselves. The so-called vinyl revival was accompanied by great interest from media theorist and pop culture, providing a solid foundation of theory and ideas which could be used as basis for this work. A reason to compare vinyl and synthesizers was to show that there are parallels which are not being covered with similar interest. Both media forms had a similar history and faced extinction when faced by the digitalization and the number of digital alternatives. Not only did they seem to come back, they also had an impact on the development of new genres like Techno and associated styles. Framing this work within the *Techno scene* allowed to include the influence of social factors and also provided a scene in which analog media always played an influential role. That's why it is also important to note that the mentioned revival was apparently not so important for this specific scene. In fact it seems to even have a negative impact on the vinyl market for Techno DJs, especially for the labels.

Still, analog media is still being used and it is clear that there are patterns between DJs and producers. There are more DJs which decide for one or the other medium while producers tend to mix analog and digital more evenly. Digital tools offer more flexibility in live situations which increases the use of those. This is also confirmed with the help of the regression showing strongest effects for *H4.3 digital functionality* in stage situation.

The necessity to look at the media usage from different angles made clear that there are a variety of theories which try to explain the use of analog media. This resulted in a total of 17 hypotheses for the main effects. Nine of them are being (partly) accepted based on a survey among users which identified themselves as part of the Techno scene. The most significant and relevant seems that *the need to touch* has a great impact of the use of analog media which is an indicator that the distinction between material/immaterial could be even more important than the one between analog/digital. This seems to be less relevant for inexperienced user in live situations as they are probably less confident. Of similar importance are digital alternatives which seem to provide important functions confirming that the digitalization has a clear impact on how the users make and perform music. At the same time this also shows that those digital opportunities are not equally important to users who still prefer analog. This is paralleled by the finding that in home situation the limits of analog media are actually desirable and a driver for creativity.

Additionally, social influences have a great impact, proving that social interaction plays an important role as well as the subcultural scene specifics (for DJs) or economic reasons (for producers). Factors like sound quality or the desire to collect items, which are backed by a lot of literature, are important to user but apparently don't have a strong influence on the actuals media usage.

In total it can be assumed that some theories about analog media seem to apply to vinyl and synthesizers. A difference lies in the situation that the term *analog synthesizer* is less defined which leads to a more complex picture regarding the market situation, different usage patterns and setups as well as o the interpretation of the term. It was shown that there is not *the one* definition but that there are rather different groups with their own interpretations of the term *analog*.

This illustrates some limitations of this work. In trying to compare vinyl and synthesizers, compromises had to be done in order to make them comparable. On the one hand, the definition of the term analog was given for DJs but not for producers. On the other hand, some media were excluded, like cassettes or modular synthesizers, which could also be considered to be analog media (in some cases) but were left out to not further increase complexity. Also, there are some differences between the groups of DJs and producers, given by the market situation. DJs are much more dependent on industry standards while producers are way more undefined in their setups which can also make it harder for them to guess their own usage pattern. If the work would have focused only on one specific group, it would have been possible to ask for more specific questions which are only relevant for one the groups but where left out to keep the group comparable.

This is also true for the statistical model. Compromises regarding model fit and used link function were necessary in order to end up with a model which works for all areas.

The use of a non-probability sampling method could result in a biased sample as it was based on social networks and online user groups. It is at least likely the media usage is not representative the whole scene as the questions about analog media could have discouraged digital users. Also many participants originated from Germany so this can be set as a reference. However, this should not impact the results of the regression as there were still enough digital users (in fact more than analog).

This opens the possibility to further analyze and understand the dataset in order to answer research questions which were not in scope for this work. This could be the search for different user groups, regional scenes and their behavior in regards to spending or preferred music styles. Also, the data could be used for more detailed analyses of either DJs or producers with more specific and different statistical models.

Last but not least, this work was about the use of analog media. It could be insightful to run a similar survey but with focus on digital media or for different music genres and theirs scenes in order to analyze similarities and differences.

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Appendix A: Economics of vinyl production for independent labels

A1: Cost structure of vinyl production

To understand why the profits are so low it is important to have a brief overview over the basic cost and income structure:

Fixed costs in €	Variable costs (per record) in €
Mastering: 30-60 per track	Vinyl: 0.5 - 1.5
Cutting: 80-110 per side	Labels: 00 -0.5
Electroplating (Galvanic): 100 – 120 per side	Cover: 00 - 1.5
Other operating costs (graphic design, GEMA, promotion, etc): 000 - 500	Innersleves: 0.10 - 0.20
Other manufacturing costs (shipping, assembly, packaging etc): 50 -150	Other manufacturing costs (for inlays, stickers, coupons, etc.): 00 - 0.30

Costs and income (all net) for vinyl record, this does not include any obligations and royalties towards the producing and/or remixing artist(s)

Taken from www.deepgrooves.eu/calculator/vinyl/ and based on own experience within the industry

The cost side is usually split into a fixed costs part which are costs which the label has to pay, no matter how many units are being produced, and a variable part which is based on the produced quantity. Especially for low production volumes the fixed costs make up a majority of the total costs. This leads to the situation that the basic principle of economy of scale applies in those cases which results in an advantage for producers of higher quantities as they can distribute the fix costs across a higher amount of units which in return lowers the price per unit, increases the margins and the budget for other expenses such as marketing. The high variance in variable costs it the result of different concepts is mainly driven by design choices. Extra costs for graphics and covers can be reduced and ignored which lead to a phenomenon exclusive to dance culture: white label releases. These are records often produced without any graphic content, so no labels or cover. Only the mandatory standard *white label* (hence the name), which sometimes is enhanced by handwriting, stamping or a sticker holds information about the release. This allows to run also on low production while still reaching break even. Additionally, low volume editions are highly collectable items, especially when being releases as vinyl only.

A2 Income based on distribution model

The choice on how many records to press and how they should look like is not only based on the price but obviously also on the expected income which is based on the chosen distribution model. There are usually three models common:

- Distribution: €4-8 per unit. The label sales to a distributor. This distributor then sales to the dealers (off - & online). As dealers and distributors take they margin it results in the lowest income for the label
- Dealer: €5-10 per unit. The label sales directly to the dealers (on & offlin estores). The margin is only taken by the dealer but it results in more administrative effort for both label and dealers as shipping has to be done individually and those shipping costs need to be distributed on each unit sold which lowers the margin.
- Customer: €8-14 per unit. The label sells directly to the customer. This can happen online through an own online shop or with the help of platforms such as discogs.com or bandcamp.com. Offline sales only possible through being present on trade shows, flea markets or events. All profits go directly to the label but the audience is usually harder to reach and they must be willing to pay individual shipping costs in case of online sales[3]

Most labels choose the way of going with a distributor, because the administrative effort to deliver to all dealers and the resulting shipping costs would be too high. Only a few labels can be allowed to deliver dealer or customers directly. Within the techno scene the German labels Giegling and Innervisions could afford to sell exclusively through their own online shop as they were hyped and had a huge fan base.

It is although common that labels combine these models: sell within their city directly to the dealers, to online shops and other cities through a distributor and direct to the customer through online platforms or at own events.

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[3] These values are just guidelines based on own experience and can vary depending on the importance of the label / artist, individual contracts or release specific properties (e.g. extended artwork, extras or special manufacturing) which could justify a higher price on the market

A3 Breakeven of a low volume pressing of a vinyl release

Based on the previous calculation a possible cost structure could look like:

- Total fixed costs for a 4 track, two-sided 12 inch: €530€ - 1100
- Flexible costs per unit: €0.6 - 4
    - Total of flexible for edition:
        - 200: €120 - 800

          300: €180 - 1200

          400: €240 – 1600
- Total costs per edition
    - 200: €650 - 1900
    - 300: €710 - 2300
    - 400: €770 - 2700

Based on the previous calculation the potential total revenue per edition could be:

- 200 units:
    - Distributor: €800 – 1600
    - Dealer: €1000 - 2000
    - Direct: €1600 – 2800
- 300 units:
    - Distributor: €1200 – 2400
    - Dealer: €1500 - 3000
    - Direct: €2400 - 4200
- 400 units:
    - Distributor: €1600 – 3200
    - Dealer: €2000 - 4000
    - Direct: €3200 – 5600

This example shows that there are combinations of costs and income structure which make it impossible to reach breakeven at all. It has to be mentioned that this risk can be mitigated by potential represses in case an edition is sold out as this makes it possible to distribute the fix costs across more units while at the same time generating more revenue. In general it can also be seen that more units make it more likely to reach breakeven or even generate profit (assuming that most units be sold).

Also, this only accounts for vinyl costs and revenue. If the release is not vinyl-only, digital sales and revenue also need to be taken into account which is difficult to model.

Appendix B: Results of survey

B1.1: Gender

Total:
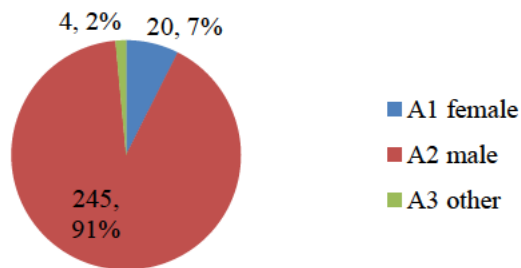
DJs:
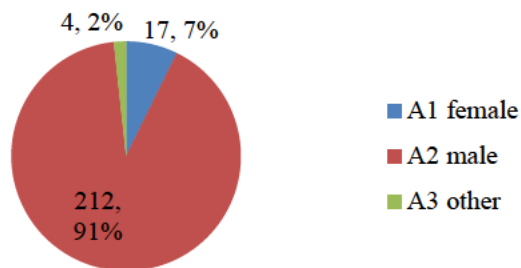
Producers:
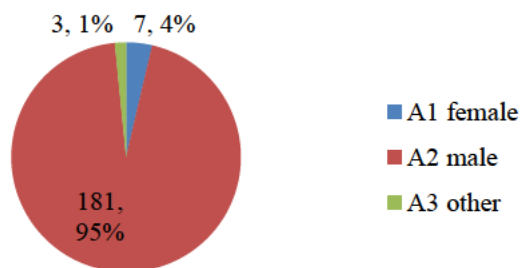
B1.2: Country

Total sample: In which country do you live ?

	Frequency	Valid Percent	Cumulative Percent
Valid	6	2,1	2,1
australia	2	,7	2,8
austria	3	1,1	3,9
belgium	2	,7	4,6
canada	1	,4	4,9
chile	1	,4	5,3
croatia	1	,4	5,6
czech republic	3	1,1	6,7
england	2	,7	7,4
finland	7	2,5	9,8
france	3	1,1	10,9
georgia	2	,7	11,6
germany	190	66,7	78,2
ireland	1	,4	78,6
italy	1	,4	78,9
lithuania	1	,4	79,3
netherlands	2	,7	80,0
new zealand	1	,4	80,4
poland	1	,4	80,7
portugal	2	,7	81,4
romania	2	,7	82,1
russia	1	,4	82,5
south africa	1	,4	82,8
spain	1	,4	83,2
sweden	3	1,1	84,2
switzerland	3	1,1	85,3
united kingdom	36	12,6	97,9
usa	6	2,1	100,0
Total	285	100,0	

B1.3: Age

Total sample

		Frequency	Valid Percent	Cumulative Percent
Valid	1959	1	0.4	0.4
	1960	1	0.4	0.7
	1967	1	0.4	1.1
	1968	1	0.4	1.5
	1969	3	1.1	2.6
	1970	1	0.4	3
	1971	5	1.9	4.9
	1972	2	0.7	5.6
	1974	2	0.7	6.3
	1975	6	2.2	8.6
	1976	11	4.1	12.7
	1977	6	2.2	14.9
	1978	8	3	17.9
	1979	11	4.1	22
	1980	7	2.6	24.6
	1981	6	2.2	26.9
	1982	8	3	29.9
	1983	7	2.6	32.5
	1984	13	4.9	37.3
	1985	12	4.5	41.8
	1986	11	4.1	45.9
	1987	10	3.7	49.6
	1988	8	3	52.6
	1989	8	3	55.6
	1990	12	4.5	60.1
	1991	15	5.6	65.7
	1992	9	3.4	69
	1993	9	3.4	72.4
	1994	26	9.7	82.1
	1995	16	6	88.1
	1996	16	6	94
	1997	8	3	97

		1998	6	2.2	99.3
		1999	1	0.4	99.6
		2001	1	0.4	100
	Total		268	100	
Missing	System		17		
Total			285		

DJs:

		Frequency	Valid Percent	Cumulative Percent
Valid	1960	1	0.4	0.4
	1967	1	0.4	0.9
	1968	1	0.4	1.3
	1969	3	1.3	2.6
	1970	1	0.4	3
	1971	5	2.2	5.2
	1972	2	0.9	6.1
	1974	2	0.9	6.9
	1975	4	1.7	8.7
	1976	11	4.8	13.4
	1977	5	2.2	15.6
	1978	6	2.6	18.2
	1979	11	4.8	22.9
	1980	6	2.6	25.5
	1981	5	2.2	27.7
	1982	6	2.6	30.3
	1983	6	2.6	32.9
	1984	12	5.2	38.1
	1985	10	4.3	42.4
	1986	8	3.5	45.9
	1987	10	4.3	50.2
	1988	8	3.5	53.7
	1989	6	2.6	56.3
	1990	12	5.2	61.5
	1991	13	5.6	67.1
	1992	8	3.5	70.6
	1993	9	3.9	74.5

		Frequency	Valid Percent	Cumulative Percent
	1994	21	9.1	83.5
	1995	11	4.8	88.3
	1996	12	5.2	93.5
	1997	7	3	96.5
	1998	6	2.6	99.1
	1999	1	0.4	99.6
	2001	1	0.4	100
	Total	231	100	
Missing	System	15		
Total		246		

Producers:

		Frequency	Valid Percent	Cumulative Percent
Valid	1959	1	0.5	0.5
	1960	1	0.5	1.1
	1967	1	0.5	1.6
	1968	1	0.5	2.1
	1969	1	0.5	2.7
	1971	2	1.1	3.7
	1972	2	1.1	4.8
	1974	2	1.1	5.9
	1975	3	1.6	7.4
	1976	7	3.7	11.2
	1977	5	2.7	13.8
	1978	4	2.1	16
	1979	6	3.2	19.1
	1980	2	1.1	20.2
	1981	5	2.7	22.9
	1982	7	3.7	26.6
	1983	3	1.6	28.2
	1984	9	4.8	33
	1985	11	5.9	38.8
	1986	5	2.7	41.5
	1987	6	3.2	44.7
	1988	5	2.7	47.3
	1989	6	3.2	50.5

1990	12	6.4		56.9
1991	9	4.8		61.7
1992	7	3.7		65.4
1993	6	3.2		68.6
1994	18	9.6		78.2
1995	15	8		86.2
1996	15	8		94.1
1997	6	3.2		97.3
1998	4	2.1		99.5
2001	1	0.5		100
	Total	188	100	
Missing	System	13		
Total		201		

B1.4: Questions about opinions on different DJ formats

I think vinyl has a different sound than files
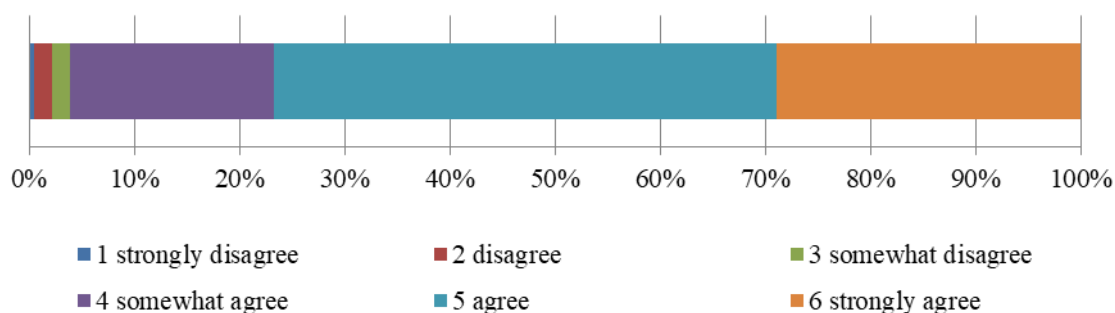
I think vinyl has a better sound than files
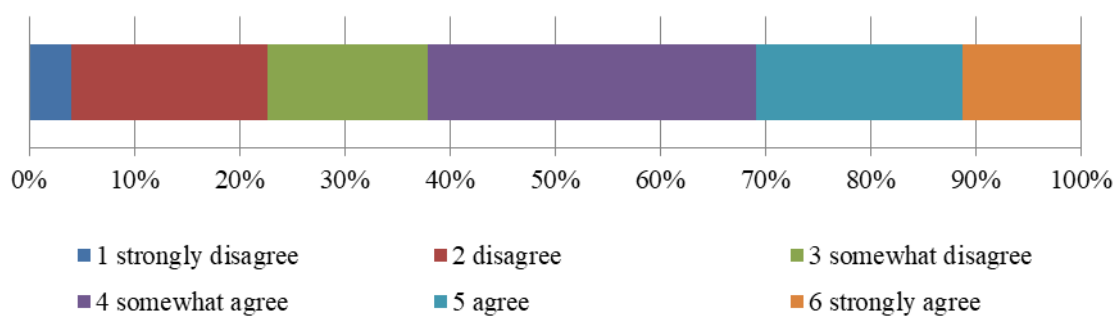
I prefer the touch of a turntable and records on it (over digital counterparts)

I prefer playing with records because it requires more skill
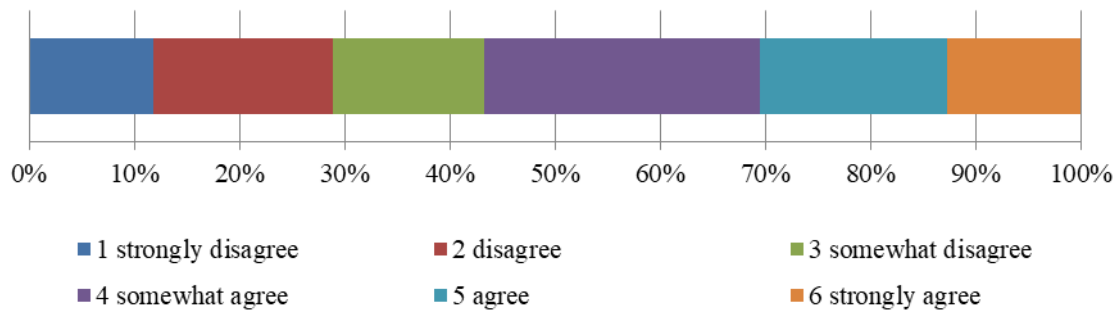
Legend:
- 1 strongly disagree
- 2 disagree
- 3 somewhat disagree
- 4 somewhat agree
- 5 agree
- 6 strongly agree

I think playing with records is more fun

Legend:
- 1 strongly disagree
- 2 disagree
- 3 somewhat disagree
- 4 somewhat agree
- 5 agree
- 6 strongly agree

I like to collect and own records

Legend:
- 1 strongly disagree
- 2 disagree
- 3 somewhat disagree
- 4 somewhat agree
- 5 agree
- 6 strongly agree
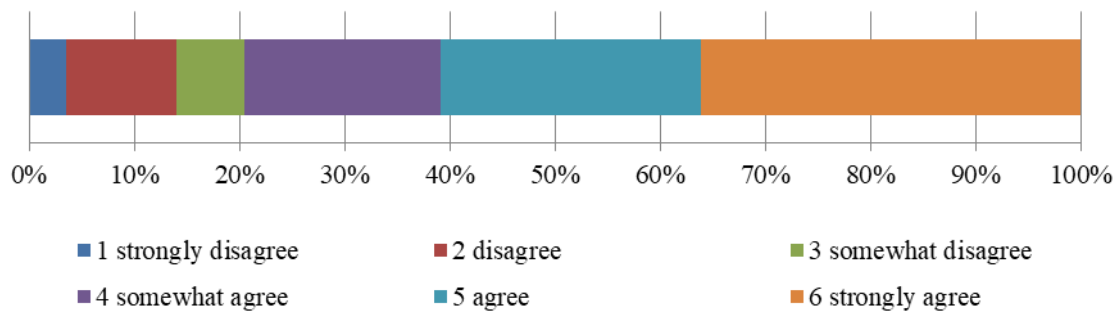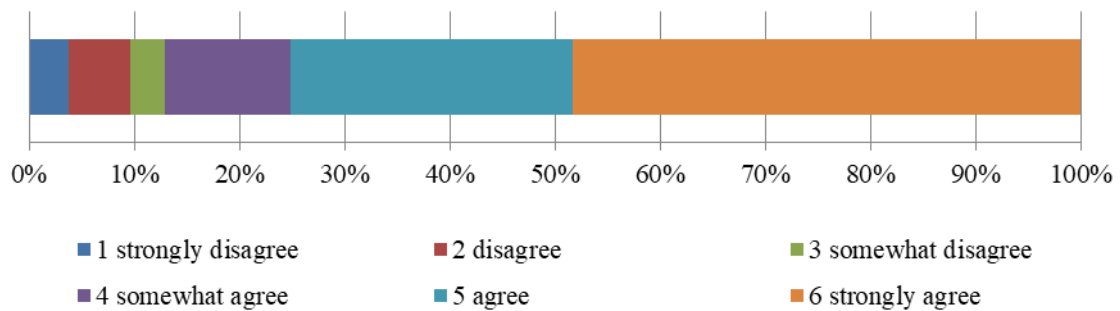
I prefer to spend money on records because they provide more value
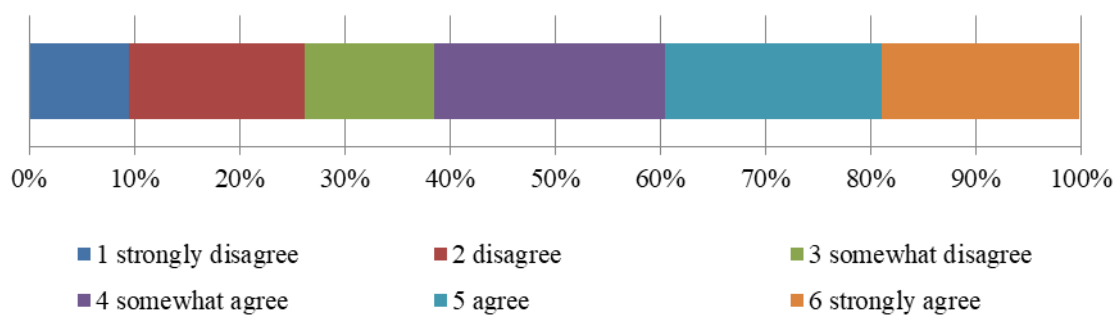
I think records are too expensive
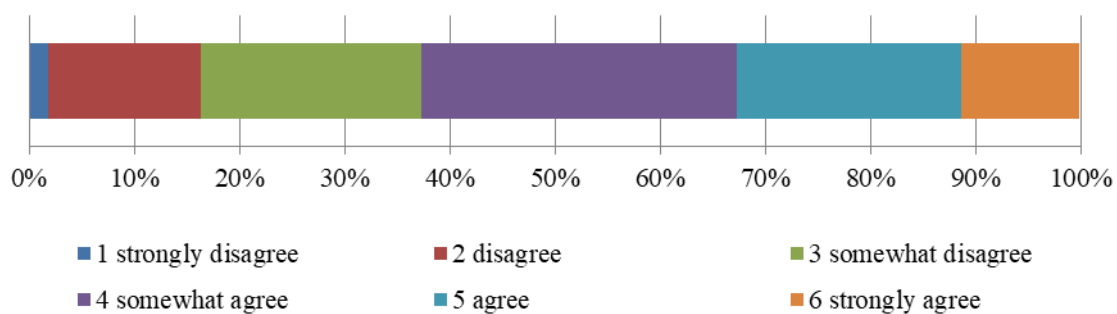
I prefer not to look at screens or interact with a digital device when DJing
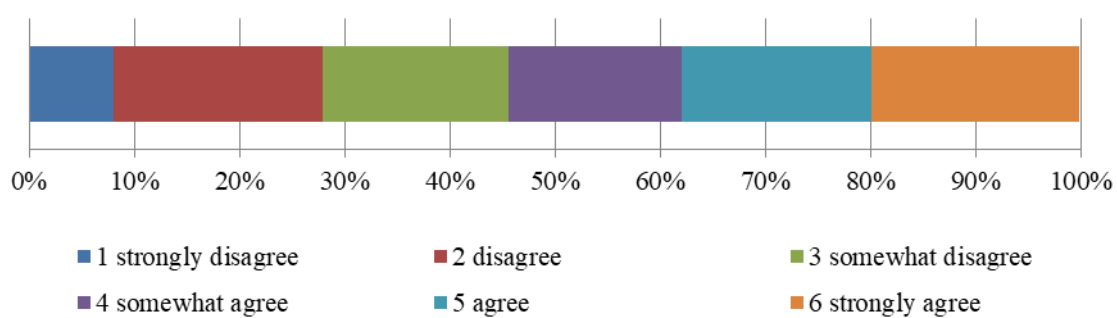
I like that digital devices offer more functionality while playing
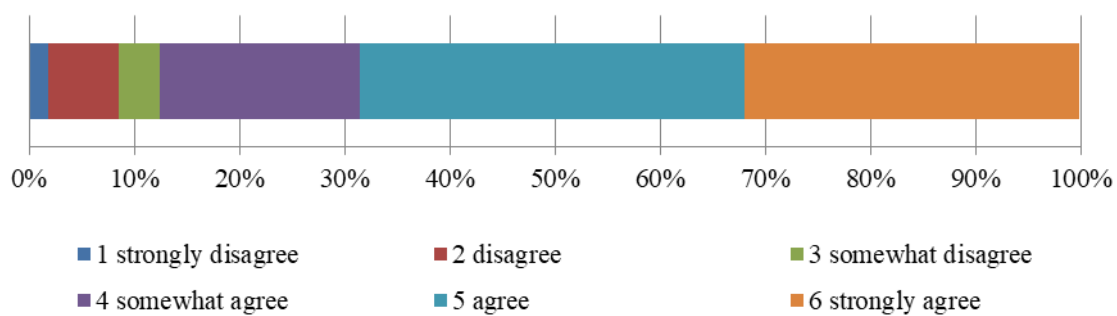
The limitation of vinyl makes me more creative
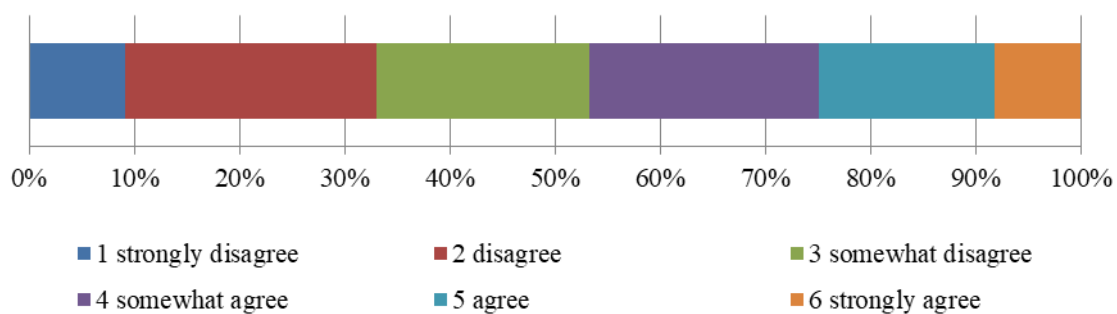
I like vinyl because it reminds me of past/better times
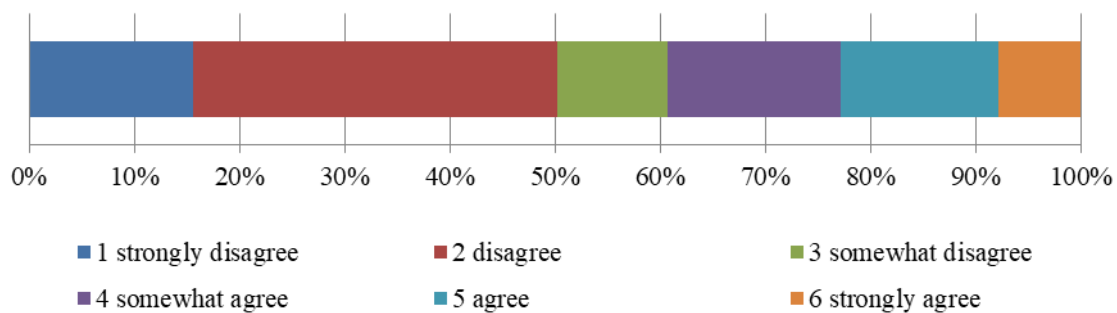
I like vinyl because I connect a lot of memories with it
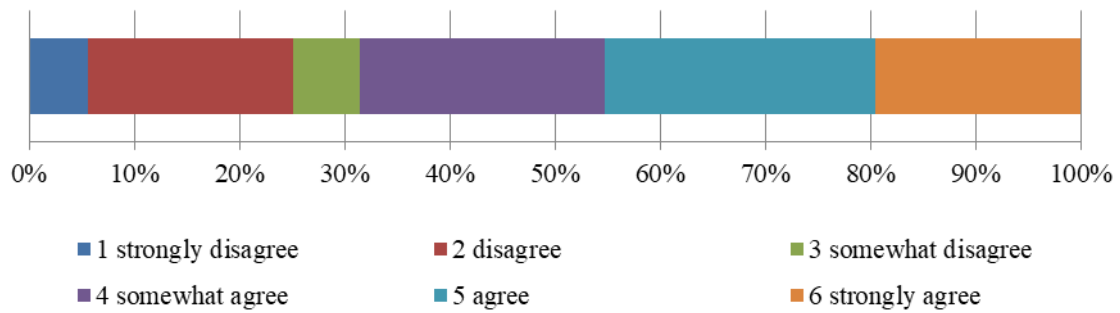
I prefer vinyl because that is the way I learned to play
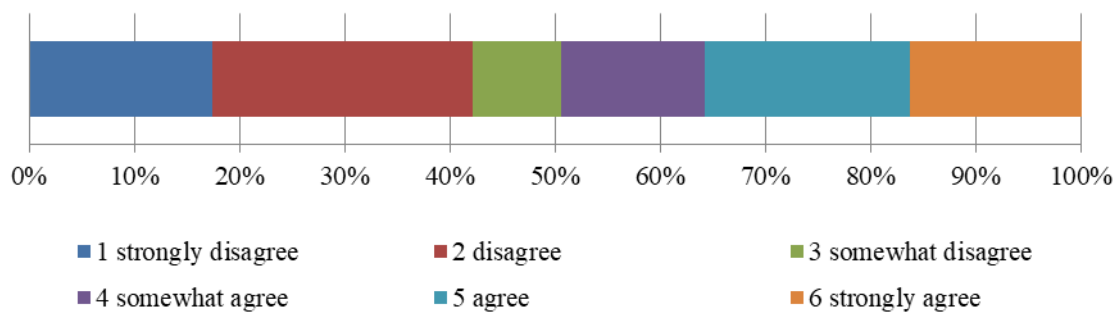
The way I DJ is inspired by the DJs or acts I admire
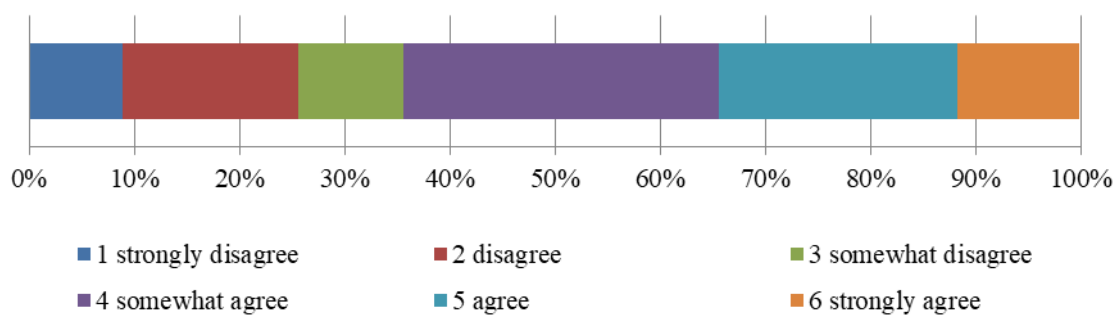
I don't play vinyl because I don't have the necessary infrastructure (record stores, setup in clubs) in my area

- 1 strongly disagree
- 2 disagree
- 3 somewhat disagree
- 4 somewhat agree
- 5 agree
- 6 strongly agree

I like vinyl because of the social activites which are connected with it ("digging", going to records stores, etc)

- 1 strongly disagree
- 2 disagree
- 3 somewhat disagree
- 4 somewhat agree
- 5 agree
- 6 strongly agree
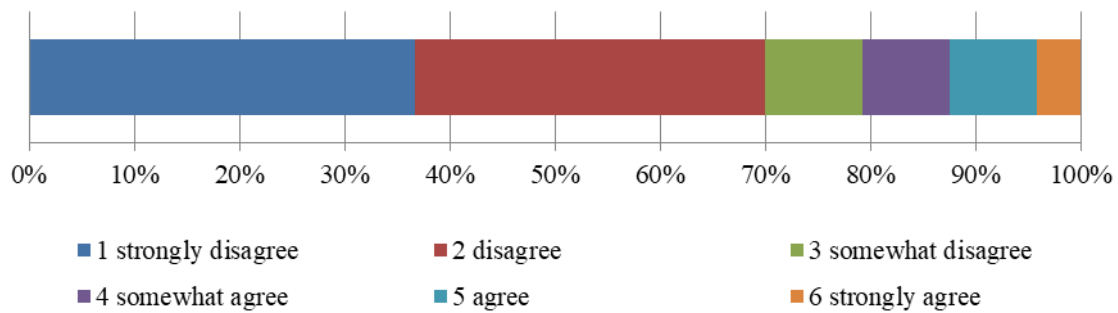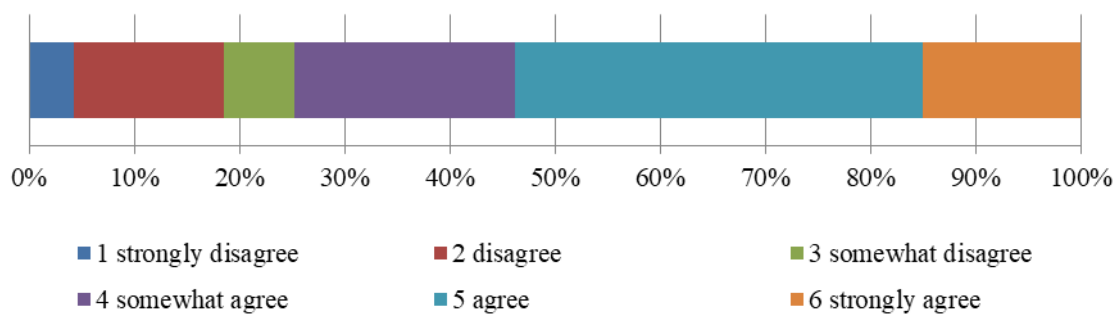
B1.5: Questions about your opinions on analog and digital synthesizers.

Provided Note:

Analog synthesizers are whatever you consider as being analog and as chosen by you in the previous question.

Digital synthesizers could be VSTs PlugIns aswell as Hardware units you would consider to be digital

I think analog synthesizers have a different sound then digital synthesizers / VSTs
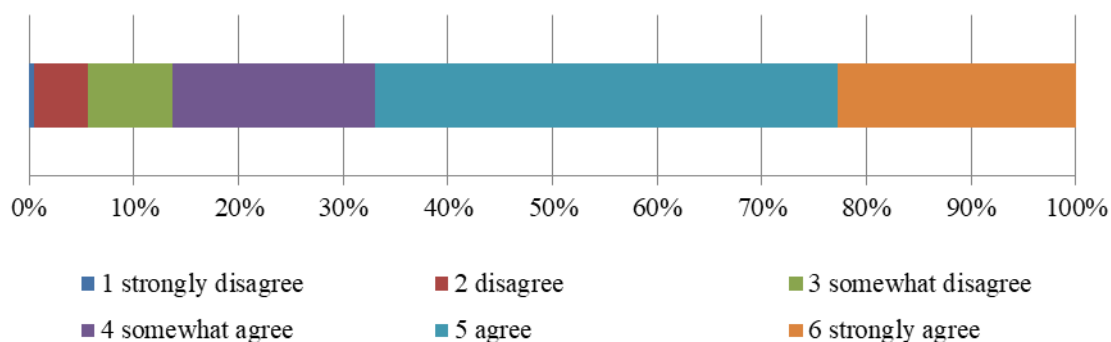
I think analog synthesizers have a better sound then digital synthesizers / VSTs
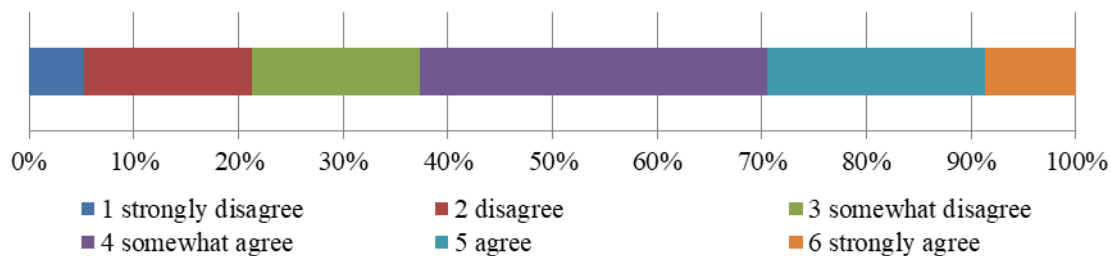
I like to touch an instruments rather than working with a mouse
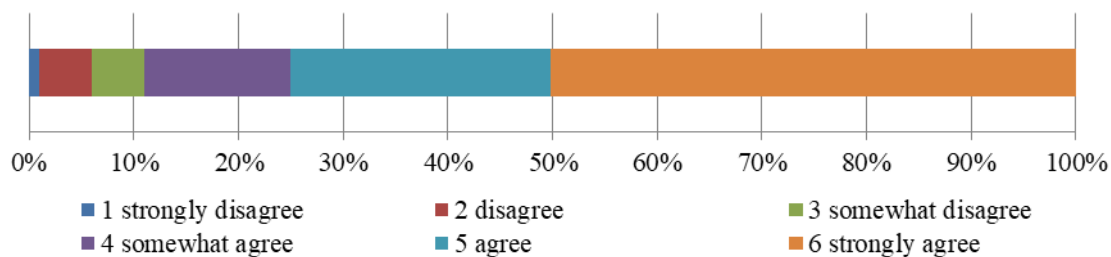
I think using analog synthesizers requires more skill
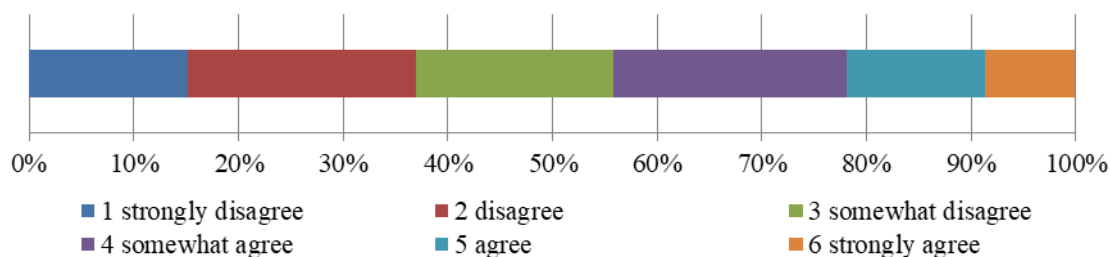
I think it is more fun to use analog synthesizers
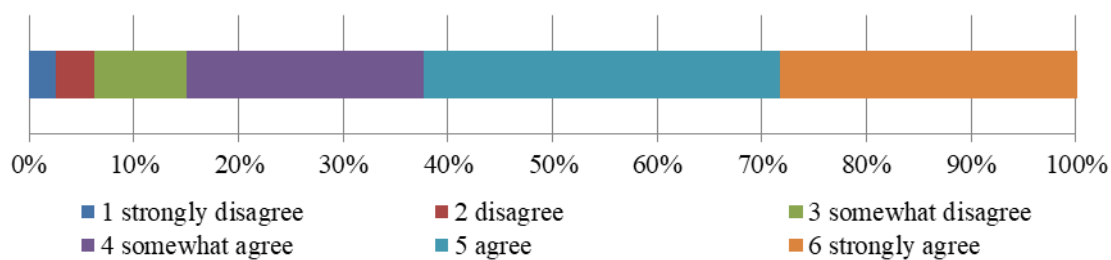
I like to own and collect analog synthesizers
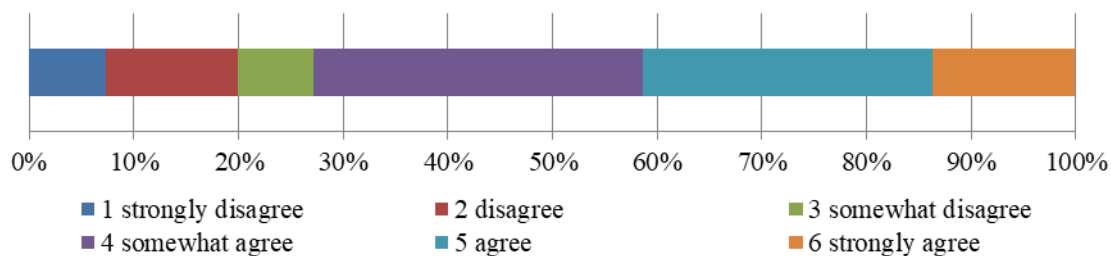
I prefer to spend money on analog synthesizers because they provide more value
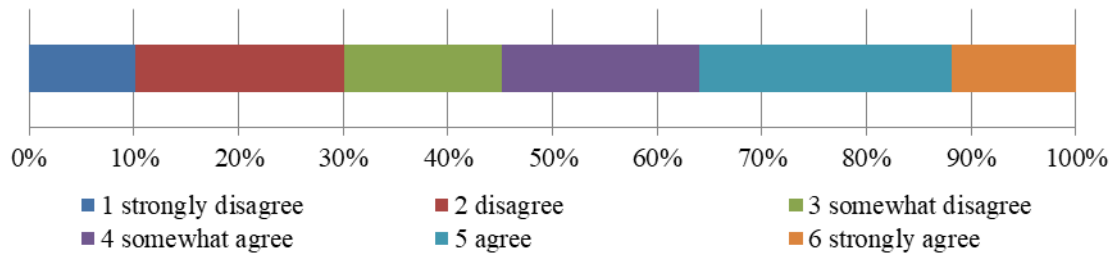
I think analog synthesizers are too expensive
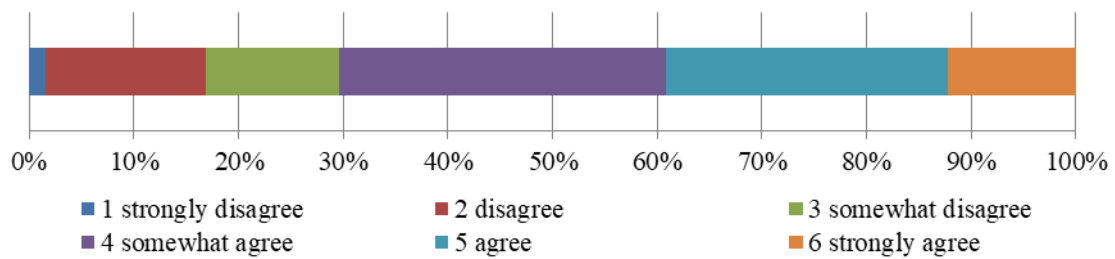
I prefer not to look at screens or interact with a digital devices when producing music
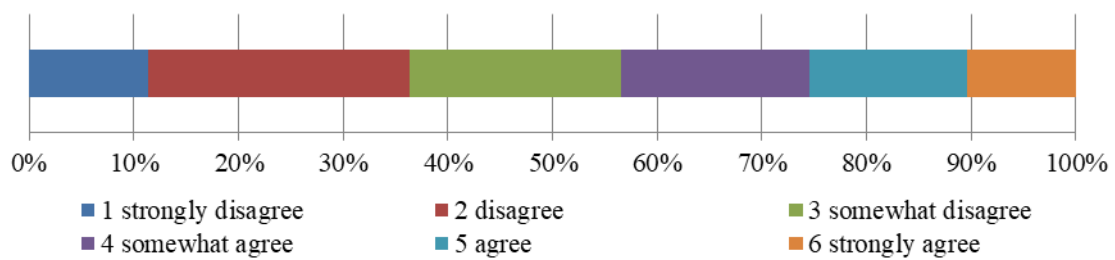
I like that digital devices offer more functionality when producing music]
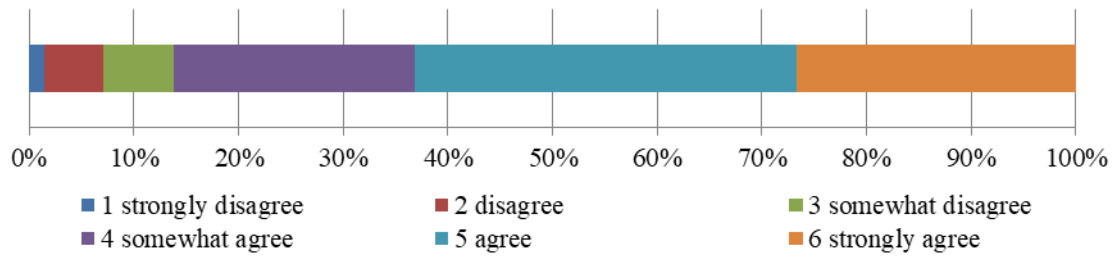
The limitations of analog synthesizers make me more creative
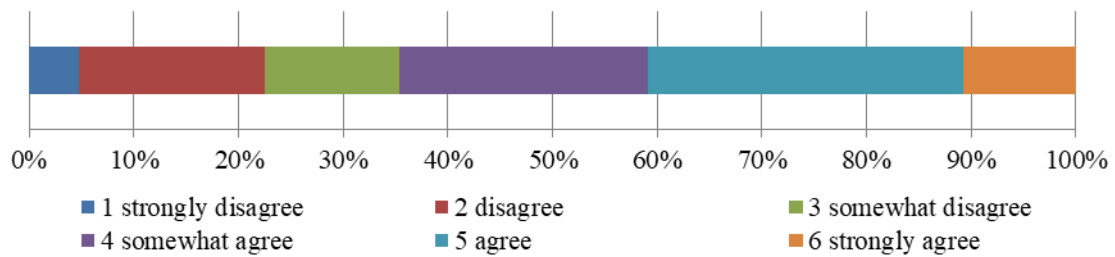
I like analog synthesizers because they reflect past/better times
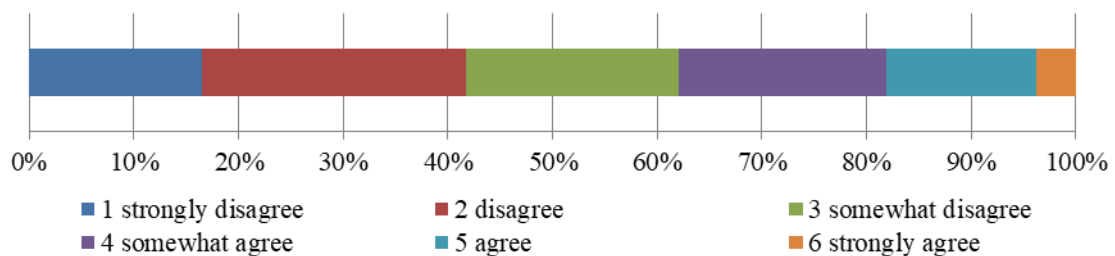
I like analog synthesizers because I connect a lot of personal memories with them
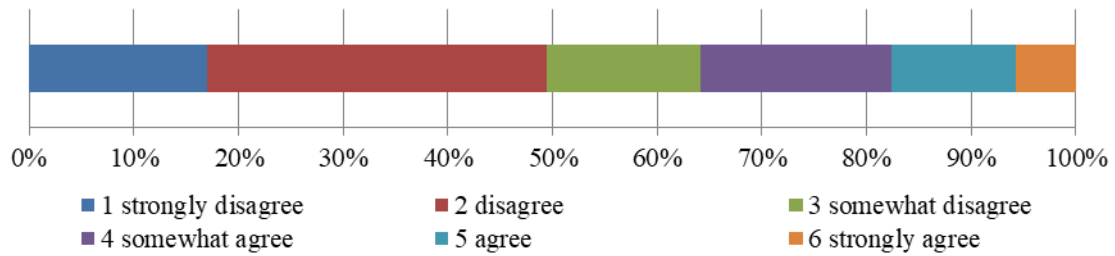
I prefer analog synthesizers because that is the way I learned it
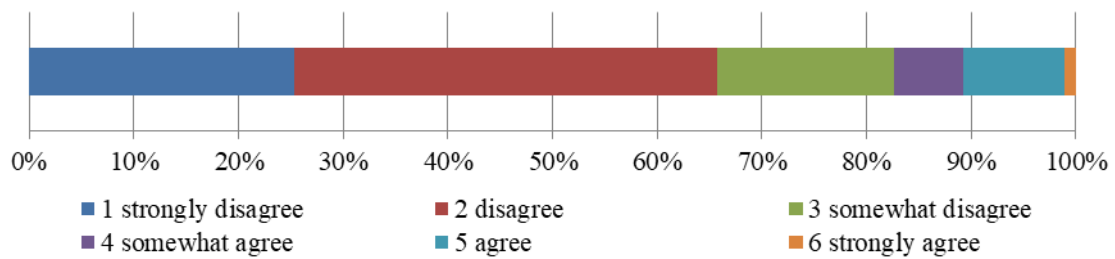
I prefer analog synthesizers because I am inspired by the Producers/Acts I admire
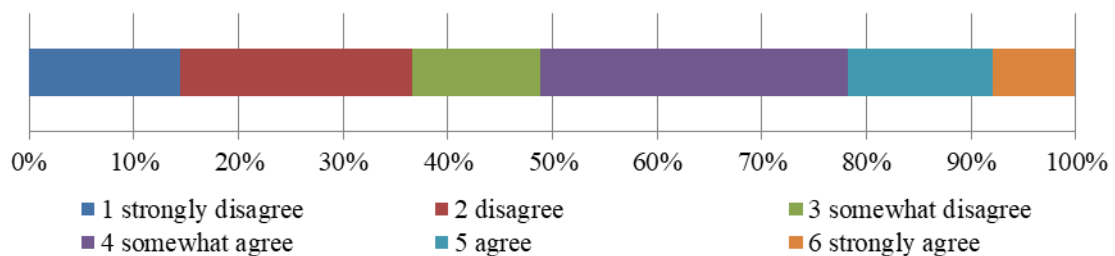
I don't use analog synthesizers because I don't have the necessary infrastructure (shops, repairs) in my area
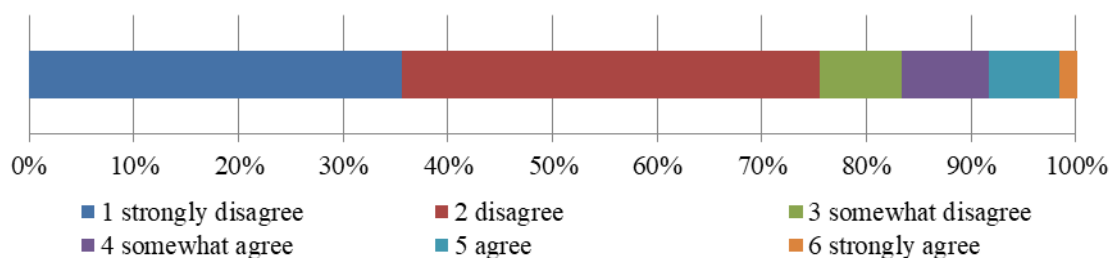
I like analog synthesizers because of the social activites which are connected with it (going to shops, playing with other people, etc)
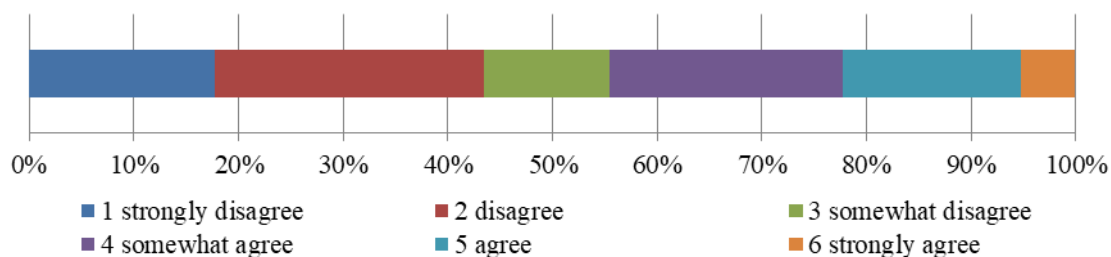
B2.1 Cluster based on experience

Result of two-step clustering: Centroids for DJs

		For how long have you been playing or DJing with the following medium ? Please answer in years & enter 0 if you don't use it all.		For how long have you been playing or DJing with the following medium ? Please answer in years & enter 0 if you don't use it all.	
		Mean	Std. Deviation	Mean	Std. Deviation
Cluster	1	23.227	5.3665	8.848	6.3882
	2	4.127	3.4409	3.402	1.9269
	3	5.507	4.3585	11.515	3.1409
Outlier (-1)		50	.	50	.
Combined		10.518	9.9272	7.494	5.9957

Result of two-step clustering: Centroids for producerss

		For how long have you been producing with the following medium ? Please answer in years		For how long have you been producing with the following medium ? Please answer in years	
		Mean	Std. Deviation	Mean	Std. Deviation
Cluster	1	1.435	1.2453	2.48	1.481
	2	5.167	3.6581	10.32	4.342
	3	20.694	7.2814	20.97	6.86
Outlier (-1)		44	.	36	.
Combined		6.93	8.435	9.64	8.009

B2.2 Cluster analog definition

Predictor importance

Variable	Content	Importance
PROD_def_seq	[sequencer or arpeggiator]	0.075
PROD_def_presets	[possibility to store presets]	0.0774
PROD_analog_definition	[menu (screen)]	0.1341
PROD_def_oscilators	[digital oscilators]	0.5326
PROD_def_effects	[digital effects]	0.563
PROD_def_envelopes	[digital envelopes]	0.851
PROD_def_lfo	[digital LFOs]	0.9094
PROD_def_filter	[digital filters]	1

B2.3 Tests of Normality

Variables which are being used for variance analysis

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Purchase power	0.324	193	0	0.404	193	0
Age	0.094	193	0	0.943	193	0
PROD_own_digital [digital synthesizers] How many synthesizers do you own ? (0 if you don't have any)	0.259	193	0	0.58	193	0
PROD_own_analog [analog synthesizers] How many synthesizers do you own ? (0 if you don't have any)	0.228	193	0	0.684	193	0
PROD_spend_analog [analog synthesizers] How much money (€) did you approximately spend on synthesizers in 2019 ?	0.325	193	0	0.444	193	0
PROD_spend_digital [digital synthesizers] How much money (€) did you approximately spend on synthesizers in 2019 ?	0.351	193	0	0.354	193	0
PROD_exp_analog [analog synthesizers] For how long have you been producing with the following medium ? Please answer in years	0.223	193	0	0.766	193	0
PROD_exp_digital [digital synthesizers] For how long have you been producing with the following medium ? Please answer in years	0.14	193	0	0.9	193	0
PROD_prof How would you describe your degree of professionality as a producer (before the Corona pandemic hit the scene) ?	0.272	193	0	0.814	193	0

a Lilliefors Significance Correction

Significane has to be > 0.05 in to pass test of normality

B2.4 Descriptive Stastictics for Clusters based on experience

Variables which are being used for variance analysis

1 hardware is important		N	Minimum	Maximum	Mean	Std. Deviation
	Purchase power	64	0	5000	861.3594	999.80218
	Age	64	1960	2001	1988.975	7.5611
	PROD_own_analog [analog synthesizers] How many synthesizers do you own ? (0 if you don't have any)	64	0	10	2.52	2.469
	PROD_own_digital [digital synthesizers] How many synthesizers do you own ? (0 if you don't have any)	64	0	50	6.2	9.155
	PROD_exp_analog [analog synthesizers] For how long have you been producing with the following medium ? Please answer in years	61	0	25	4.59	5.5366
	PROD_exp_digital [digital synthesizers] For how long have you been producing with the following medium ? Please answer in years	61	0	25	6.61	5.849
	Valid N (listwise)	61				

2 analog sound is important		N	Minimum	Maximum	Mean	Std. Deviation
	Purchase power	91	0	30000	1636.1538	3573.84691
	Age	91	1959	1997	1986.141	7.4929
	PROD_own_analog [analog synthesizers] How many synthesizers do you own ? (0 if you don't have any)	91	0	25	4.12	4.699
	PROD_own_digital [digital synthesizers] How many synthesizers do you own ? (0 if you don't have any)	91	0	100	8.84	13.895
	PROD_exp_analog [analog synthesizers] For how long have you been producing with the following medium ? Please answer in years	89	0	44	8.287	8.8856
	PROD_exp_digital [digital synthesizers] For how long have you been producing with the following medium ? Please answer in years	90	0	36	11.66	8.515
	Valid N (listwise)	88				

3 analog purists		N	Minimum	Maximum	Mean	Std. Deviation
	Purchase power	46	0	9500	786.2391	1773.70258
	Age	46	1968	1998	1987.508	8.2236
	PROD_own_analog [analog synthesizers] How many synthesizers do you own ? (0 if you don't have any)	46	0	28	3.57	6.065
	PROD_own_digital [digital synthesizers] How many synthesizers do you own ? (0 if you don't have any)	46	0	100	11.04	16.746
	PROD_exp_analog [analog synthesizers] For how long have you been producing with the following medium ? Please answer in years	44	0	35	7.341	10.0971
	PROD_exp_digital [digital synthesizers] For how long have you been producing with the following medium ? Please answer in years	46	0	30	9.02	8.323
	Valid N (listwise)	44				

B3.1 Comparison link functions

Comparison of different link functions, based on dependent variable with three groups

Dependend Variable	Link function	Model Fitting Information -2 Log Likelihood	Sig	Goodness- of Fit Pearson	Deviance	Pseudo R Square Nagelkerke	Test of parallel lines Sig
DJ HOME	Cauchit.	281.73	0	0	1	0.586	0.912
DJ HOME	Complementary Log-log.	244.562	0	0.027	1	0.673	0.753
DJ HOME	Logit.	281.873571	0	0	1	0.585	0.662
DJ HOME	Negative Log-log.	280.554	0.00E+00	0.018	1	0.589	0.439
DJ HOME	Probit.	283.769	0	0	1	0.58	0.744
DJ STAGE	Cauchit.	225.339	0	0	1	0.589	0.006
DJ STAGE	Complementary Log-log.	121.354	0	0	1	0.833	1
DJ STAGE	Logit.	231.137	0	0	1	0.572	1
DJ STAGE	Negative Log-log.	230.73	0	0	1	0.573	0.95
DJ STAGE	Probit.	235.298	0	0	1	0.559	0.892
PROD HOME	Cauchit.	296.529	2.73E-11	0.585	0.988209	0.444676	0.930734
PROD HOME	Complementary Log-log.	296.274	0	0.684	0.989	0.446	0.942
PROD HOME	Logit.	294.255	0	0.371	0.991	0.453	0.957
PROD HOME	Probit.	294.183	0	0.485	0.991	0.453	1
PROD HOME	Negative Log-log.	292.751	0	0.577	0.992334	0.459	0.999
PROD STAGE	Cauchit.	183.588	0	0	0.921	0.463	0
PROD STAGE	Complementary Log-log.	163.701019	2.83E-09	0.551	0.904438	0.569	0.012
PROD STAGE	Logit.	192.114	0	0.241	0.833	0.412	0.259
PROD STAGE	Negative Log-log.	198.256	0.001	0.41	0.742	0.373	0.151
PROD STAGE	Probit.	192.395	0	0.419	0.829078	0.41	0.524
Note:	colorcoding:	lowest best	Should be <0.05	should be >0.05	should be >0.05	highest best	should be >0.05

B3.2 Comparison of groups of dependent variable

Dependend Variable	Number of groups	Model Fitting Information		Goodness-of Fit		Pseudo R Square	Test of parallel lines
		-2 Log Likelihood	Sig	Pearson	Deviance	Nagelkerke	Sig
DJ HOME	3	244.562	0	0.027	1	0.673	0.753
DJ HOME	5	454.207	0	0	1	0.719	0
DJ HOME	7	625.631	0	0	1	0.606	0
DJ STAGE	3	121.354	0	0	1	0.833	1
DJ STAGE	5	403.171	0	0	1	0.693	0
DJ STAGE	7	506.704	0	0	1	0.681	0
PROD HOME	3	296.274	0.00E+00	0.684	0.989	0.446	0.942
PROD HOME	5	288.241	0	0	1	0.779	0
PROD HOME	7	371.039	0	0	1	0.833	0
PROD STAGE	3	163.701019	0	0.551	0.904	0.569	0.012
PROD STAGE	5	302.829	1.00E-03	0.673	1	0.335	1
PROD STAGE	7	399.396	0.006	0.664	1	0.291	0
Note:	colorcoding:	*lowest best*	*Should be <0.05*	*should be >0.05*	*should be >0.05*	*highest best*	*should be >0.05*

B3.3 Survey and hypotheses

Each hypothesis has a short form and the respective statement for DJ and producer area

H1.1 different sound: Using analog media is (positively) dependent on thinking that analog sounds different.

- DJ: I think vinyl has a different sound than files
- Producer: I think analog synthesizers have a different sound then digital synthesizers / VSTs

H1.2 better sound: Using analog media is (positively) dependent on thinking that analog sounds better.

- DJ: I think vinyl has a better sound than files;
- Producer: I think analog synthesizers have a better sound then digital synthesizers / VSTs

H2.1 prefer touch: Using analog media is (positively) dependent on the preference to touch and interact with objects.

- DJ: I prefer the touch of a turntable and records on it (over digital counterparts)
- Producer: I like to touch an instruments rather than working with a mouse

H2.2 requires skill: Using analog media is (positively) dependent on the assumption that it requires more skill.

- DJ: I prefer playing with records because it requires more skill
- Producer: I think using analog synthesizers requires more skill

H2.3 more fun: Using analog media is (positively) dependent on the assumption that it is more fun.

- DJ: I think playing with records is more fun
- Producer: I think it is more fun to use analog synthesizers

H3.1 collecting: Using analog media is (positively) dependent on the need to collect and possess analog media.

- DJ: I like to collect and own records
- Producer: I like to own and collect analog synthesizers

H3.2 more value: Using analog media is (positively) dependent on the perception that physical items are more valuable.

- DJ: I prefer to spend money on records because they provide more value
- Producer: I prefer to spend money on analog synthesizers because they provide more value

H3.3 analog too expensive: Using analog media is (negatively) dependent on the perception that physical items too expensive.

- DJ: I think records are too expensive
- Producer: I think analog synthesizers are too expensive

H3.4. Using analog media is (positively) dependent on the social activities which are connected to it.

- DJ: I like vinyl because of the social activites which are connected with it ("digging", going to records stores, etc)
- Producer: I like analog synthesizers because of the social activites which are connected with it (going to shops, playing with other people, etc)

H4.1 no screen: Using analog media is (positively) dependent on the preference to work without a screen.

- DJ: I prefer not to look at screens or interact with a digital device when DJing
- Producer: I prefer not to look at screens or interact with a digital devices when producing music

H4.2 creative limits: Using analog media is (positively) dependent on limits of analog media.

- DJ: The limitation of vinyl makes me more creative
- Producer: The limitations of analog synthesizers make me more creative

H4.3 digital functionality: Using analog media is (negatively) dependent on possibilities digital devices offer.

- DJ: I like that digital devices offer more functionality while playing
- Producer: I like that digital devices offer more functionality when producing music

H5.1 Retromania: Using analog media is (positively) dependent on the appreciation of older times (retromania)

- DJ: I like vinyl because it reminds me of past/better times
- Producer: I like analog synthesizers because they reflect past/better times

H5.2 nostalgia: Using analog media is (positively) dependent on the importance it had one ones past (nostalgia)

- DJ: I like vinyl because I connect a lot of memories with it
- Producer: I like analog synthesizers because I connect a lot of personal memories with them

H5.3 personal history:. Using analog media is (positively) dependent on the way it was learned

- DJ: I prefer vinyl because that is the way I learned to play
- Producer: I prefer analog synthesizers because that is the way I learned it

H6.1 role models: Using analog media is (positively) dependent on scene specific standard set by role models

- DJ: The way I DJ is inspired by the DJs or acts I admire
- Producer: I prefer analog synthesizers because I am inspired by the Producers/Acts I admire.

H6.2 infrastructure: Using analog media is (negatively) dependent on scene specific standard influenced by regional limitations such as infrastructure

- DJ: I don't play vinyl because I don't have the necessary infrastructure (record stores, setup in clubs) in my area
- Producer: I don't use analog synthesizers because I don't have the necessary infrastructure (shops, repairs) in my area

B3.4 Result of ordinal regression (main effects)

DJs at home (in order of asked in the survey)

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Threshold	[D_Home3 = 1,00]	-5.316	32.084	0.027	1	0.868	-68.199	57.567
	[D_Home3 = 2,00]	-4.766	32.083	0.022	1	0.882	-67.648	58.115
Location	H1.1 different sound	-0.216	0.133	2.644	1	0.104	-0.476	0.044
	H1.2 better sound	-0.005	0.097	0.003	1	0.957	-0.195	0.185
	H2.1 prefer touch	0.233	0.102	5.221	1	0.022	0.033	0.433
	H2.2 requires skill	-0.093	0.088	1.12	1	0.29	-0.265	0.079
	H2.3 more fun	0.018	0.101	0.033	1	0.855	-0.179	0.216
	H3.1 collecting	0.088	0.106	0.68	1	0.41	-0.121	0.296
	H3.2 more value	0.1	0.086	1.356	1	0.244	-0.068	0.267
	H3.3 analog too expensive	0.142	0.089	2.515	1	0.113	-0.033	0.316
	H4.1 no screen	0.105	0.079	1.76	1	0.185	-0.05	0.261
	H4.3 digital functionality	-0.296	0.115	6.653	1	0.01	-0.521	-0.071
	H4.2 creative limits	0.187	0.095	3.883	1	0.049	0.001	0.373
	H5.1 Retromania	-0.006	0.092	0.004	1	0.952	-0.187	0.176
	H5.2 nostalgia	0.131	0.086	2.347	1	0.126	-0.037	0.299
	H5.3 personal history	0.061	0.077	0.632	1	0.427	-0.09	0.213
	H6.1 role models	-0.111	0.08	1.914	1	0.166	-0.267	0.046
	H6.2 infrastructure	-0.3	0.08	14.22	1	0	-0.456	-0.144
	H3.4 social interaction	0.321	0.095	11.464	1	0.001	0.135	0.507
	Purchase power	0	0.001	0.177	1	0.674	-0.002	0.001
	Gender	-0.643	0.461	1.946	1	0.163	-1.545	0.26
	Age	-0.003	0.016	0.032	1	0.857	-0.034	0.029

Link function:
Complementary Log-log.

DJs on stage (in order of asked in the survey)

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[D_Stage3 = 1,00]	-15.037	32.374	0.216	1	0.642	-78.49	48.415
	[D_Stage3 = 2,00]	-14.615	32.373	0.204	1	0.652	-78.065	48.835
Location	H1.1 different sound	-0.364	0.142	6.572	1	0.01	-0.643	-0.086
	H1.2 better sound	-0.026	0.094	0.075	1	0.784	-0.21	0.159
	H2.1 prefer touch	0.26	0.105	6.097	1	0.014	0.054	0.466
	H2.2 requires skill	-0.155	0.09	2.975	1	0.085	-0.331	0.021
	H2.3 more fun	0.14	0.103	1.871	1	0.171	-0.061	0.341
	H3.1 collecting	-0.086	0.113	0.577	1	0.447	-0.309	0.136
	H3.2 more value	0.099	0.089	1.224	1	0.269	-0.076	0.274
	H3.3 analog too expensive	0.023	0.086	0.07	1	0.791	-0.147	0.192
	H4.1 no screen	0.034	0.082	0.173	1	0.677	-0.127	0.196
	H4.3 digital functionality	-0.398	0.112	12.613	1	0	-0.617	-0.178
	H4.2 creative limits	0.07	0.094	0.555	1	0.456	-0.114	0.254
	H5.1 Retromania	0.028	0.093	0.092	1	0.762	-0.154	0.21
	H5.2 nostalgia	0.067	0.087	0.587	1	0.443	-0.104	0.237
	H5.3 personal history	0.187	0.076	6.073	1	0.014	0.038	0.336
	H6.1 role models	-0.14	0.084	2.772	1	0.096	-0.305	0.025
	H6.2 infrastructure	-0.188	0.085	4.884	1	0.027	-0.356	-0.021
	H3.4 social interaction	0.267	0.097	7.619	1	0.006	0.077	0.456
	Purchase power	0.001	0.001	0.593	1	0.441	-0.001	0.002
	Gender	-0.13	0.387	0.114	1	0.736	-0.889	0.628
	Age	-0.007	0.016	0.188	1	0.664	-0.039	0.025

Link function:
Complementary Log-log.

Producers at home (in order of asked in the survey)

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[P_Home3 = 1,00]	-56.322	29.586	3.624	1	0.057	-114.309	1.666
	[P_Home3 = 2,00]	-55.408	29.577	3.51	1	0.061	-113.377	2.561
Location	H1.1 different sound	0.158	0.106	2.219	1	0.136	-0.05	0.366
	H1.2 better sound	-0.198	0.11	3.238	1	0.072	-0.413	0.018
	H2.1 prefer touch	0.4	0.115	12.062	1	0.001	0.174	0.626
	H2.2 requires skill	0.149	0.077	3.762	1	0.052	-0.002	0.299
	H2.3 more fun	0.129	0.108	1.429	1	0.232	-0.082	0.34
	H3.1 collecting	0.009	0.089	0.01	1	0.921	-0.166	0.184
	H3.2 more value	-0.023	0.087	0.068	1	0.794	-0.192	0.147
	H3.3 analog too expensive	-0.23	0.094	6.022	1	0.014	-0.413	-0.046
	H4.1 no screen	0.105	0.076	1.902	1	0.168	-0.044	0.254
	H4.3 digital functionality	-0.244	0.099	6.113	1	0.013	-0.438	-0.051
	H4.2 creative limits	0.207	0.095	4.738	1	0.03	0.021	0.393
	H5.1 Retromania	0.11	0.098	1.255	1	0.263	-0.083	0.303
	H5.2 nostalgia	-0.018	0.096	0.036	1	0.85	-0.205	0.169
	H5.3 personal history	0.242	0.115	4.442	1	0.035	0.017	0.468
	H6.1 role models	-0.159	0.083	3.625	1	0.057	-0.322	0.005
	H6.2 infrastructure	-0.023	0.091	0.067	1	0.796	-0.202	0.155
	H3.4 social interaction	-0.165	0.087	3.582	1	0.058	-0.335	0.006
	Purchase power	0	7.89E-05	2.197	1	0.138	-3.77E-05	0
	Gender	0.175	0.678	0.066	1	0.797	-1.154	1.504
	Age	-0.029	0.015	3.866	1	0.049	-0.058	-9.29E-05

Link function:
Complementary Log-log.

Producers on stage (in order of asked in the survey)

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[P_Stage3 = 1,00]	48.642	37.857	1.651	1	0.199	-25.556	122.84
	[P_Stage3 = 2,00]	49.997	37.875	1.743	1	0.187	-24.237	124.232
Location	H1.1 different sound	0.061	0.128	0.229	1	0.632	-0.189	0.311
	H1.2 better sound	-0.043	0.134	0.101	1	0.75	-0.305	0.22
	H2.1 prefer touch	0.351	0.136	6.618	1	0.01	0.084	0.618
	H2.2 requires skill	0.182	0.095	3.665	1	0.056	-0.004	0.369
	H2.3 more fun	0.078	0.134	0.337	1	0.561	-0.185	0.341
	H3.1 collecting	0.037	0.124	0.09	1	0.765	-0.205	0.279
	H3.2 more value	0.336	0.125	7.247	1	0.007	0.091	0.58
	H3.3 analog too expensive	-0.44	0.135	10.594	1	0.001	-0.705	-0.175
	H4.1 no screen	-0.008	0.107	0.006	1	0.939	-0.218	0.201
	H4.3 digital functionality	-0.323	0.124	6.796	1	0.009	-0.565	-0.08
	H4.2 creative limits	0.158	0.125	1.583	1	0.208	-0.088	0.403
	H5.1 Retromania	0.311	0.128	5.914	1	0.015	0.06	0.562
	H5.2 nostalgia	0.011	0.123	0.008	1	0.931	-0.231	0.253
	H5.3 personal history	-0.117	0.138	0.725	1	0.395	-0.388	0.153
	H6.1 role models	-0.401	0.128	9.774	1	0.002	-0.653	-0.15
	H6.2 infrastructure	0.22	0.125	3.079	1	0.079	-0.026	0.466
	H3.4 social interaction	-0.262	0.117	4.965	1	0.026	-0.492	-0.032
	Purchase power	0	0	2.412	1	0.12	-4.58E-05	0
	Gender	-1.557	0.908	2.94	1	0.086	-3.336	0.223
	Age	0.025	0.019	1.767	1	0.184	-0.012	0.062

Link function:
Complementary Log-log.

B3.5 Result of ordinal regression (including interaction)

DJs at home (in order of asked in the survey)

Parameter
Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[D_Home3 = 1,00]	-51.768	47.005	1.213	1	0.271	-143.897	40.361
	[D_Home3 = 2,00]	-51.145	47.002	1.184	1	0.277	-143.267	40.977
Location	Cluster 1: analog experience	0.6	1.355	0.196	1	0.658	-2.055	3.256
	Cluster 2 :digital experience	-0.977	1.33	0.539	1	0.463	-3.584	1.631
	Cluster 3: less experience	0a	.	.	0	.	.	.
	H1.1 different sound	-0.229	0.142	2.592	1	0.107	-0.507	0.05
	H1.2 better sound	0.006	0.108	0.003	1	0.953	-0.206	0.218
	H2.1 prefer touch	0.403	0.161	6.266	1	0.012	0.087	0.718
	H2.2 requires skill	-0.357	0.149	5.715	1	0.017	-0.65	-0.064
	H2.3 more fun	0.122	0.16	0.585	1	0.445	-0.191	0.436
	H3.1 collecting	0.239	0.128	3.48	1	0.062	-0.012	0.49
	H3.2 more value	0.1	0.096	1.077	1	0.299	-0.089	0.289
	H3.3 analog too expensive	0.165	0.1	2.702	1	0.1	-0.032	0.361
	H4.1 no screen	0.099	0.085	1.343	1	0.247	-0.068	0.267
	H4.3 digital functionality	-0.35	0.122	8.168	1	0.004	-0.59	-0.11
	H4.2 creative limits	0.219	0.101	4.752	1	0.029	0.022	0.417
	H5.1 Retromania	0.007	0.102	0.005	1	0.943	-0.192	0.207
	H5.2 nostalgia	0.131	0.092	2.028	1	0.154	-0.049	0.31
	H5.3 personal history	0.014	0.087	0.025	1	0.874	-0.157	0.185
	H6.1 role models	-0.12	0.088	1.85	1	0.174	-0.293	0.053
	H6.2 infrastructure	-0.424	0.094	20.379	1	0	-0.608	-0.24
	H3.4 social interaction	0.362	0.108	11.261	1	0.001	0.151	0.574
	Purchase power	0	0.001	0.201	1	0.654	-0.002	0.001
	Gender	-0.817	0.496	2.715	1	0.099	-1.789	0.155
	Age	-0.027	0.024	1.261	1	0.261	-0.073	0.02

	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
1 * H2.1 prefer touch	-0.055	0.268	0.042	1	0.838	-0.579	0.47
2 * H2.1 prefer touch	-0.668	0.279	5.744	1	0.017	-1.214	-0.122
3 * H2.1 prefer touch	0a	.	.	0	.	.	
1 * H2.2 requires skill	-0.086	0.218	0.157	1	0.692	-0.513	0.341
2 * H2.2 requires skill	0.945	0.266	12.576	1	0	0.423	1.467
3 * H2.2 requires skill	0a	.	.	0	.	.	
1 * H2.3 more fun	-0.074	0.244	0.093	1	0.76	-0.552	0.403
2 * H2.3 more fun	0.159	0.274	0.336	1	0.562	-0.378	0.695
3 * H2.3 more fun	0a	.	.	0	.	.	

Link function: Complementary Log-log.

a This parameter is set to zero because it is redundant.

DJs on stage (in order of asked in the survey)

Parameter
Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[D_Stage3 = 1,00]	-38.229	45.596	0.703	1	0.402	-127.597	51.138
	[D_Stage3 = 2,00]	-37.762	45.594	0.686	1	0.408	-127.125	51.601
Location	Cluster 1: analog experience	0.047	1.396	0.001	1	0.973	-2.689	2.784
	Cluster 2 :digital experience	-1.771	1.473	1.446	1	0.229	-4.658	1.116
	Cluster 3: less experience	0a	.	.	0	.	.	
	H1.1 different sound	-0.488	0.163	8.925	1	0.003	-0.808	-0.168
	H1.2 better sound	0.014	0.104	0.017	1	0.896	-0.19	0.217
	H2.1 prefer touch	0.275	0.168	2.68	1	0.102	-0.054	0.604
	H2.2 requires skill	-0.261	0.141	3.423	1	0.064	-0.537	0.015
	H2.3 more fun	0.161	0.152	1.118	1	0.29	-0.137	0.458
	H3.1 collecting	-0.087	0.133	0.423	1	0.516	-0.348	0.175
	H3.2 more value	0.165	0.1	2.727	1	0.099	-0.031	0.36
	H3.3 analog too expensive	0.033	0.094	0.126	1	0.722	-0.15	0.217
	H4.1 no screen	0.032	0.088	0.135	1	0.714	-0.14	0.205
	H4.3 digital functionality	-0.4	0.116	11.963	1	0.001	-0.627	-0.173
	H4.2 creative limits	0.069	0.101	0.47	1	0.493	-0.129	0.268
	H5.1 Retromania	0.077	0.101	0.582	1	0.446	-0.121	0.275
	H5.2 nostalgia	0.01	0.093	0.011	1	0.916	-0.172	0.192
	H5.3 personal history	0.242	0.084	8.412	1	0.004	0.079	0.406
	H6.1 role models	-0.142	0.091	2.434	1	0.119	-0.321	0.036
	H6.2 infrastructure	-0.267	0.1	7.061	1	0.008	-0.464	-0.07
	H3.4 social interaction	0.257	0.103	6.235	1	0.013	0.055	0.459
	Purchase power	0.001	0.001	0.408	1	0.523	-0.001	0.002
	Gender	-0.22	0.405	0.295	1	0.587	-1.013	0.573
	Age	-0.018	0.023	0.647	1	0.421	-0.063	0.027

	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
1 * H2.1 prefer touch	-0.015	0.274	0.003	1	0.956	-0.552	0.522
2 * H2.1 prefer touch	0.125	0.304	0.17	1	0.68	-0.471	0.721
3 * H2.1 prefer touch	0a	.	.	0	.	.	
1 * H2.2 requires skill	-0.247	0.206	1.429	1	0.232	-0.651	0.158
2 * H2.2 requires skill	0.535	0.243	4.846	1	0.028	0.059	1.01
3 * H2.2 requires skill	0a	.	.	0	.	.	
1 * H2.3 more fun	0.192	0.281	0.465	1	0.495	-0.359	0.743
2 * H2.3 more fun	-0.099	0.264	0.14	1	0.709	-0.616	0.419
3 * H2.3 more fun	0a	.	.	0	.	.	

Link function: Complementary Log-log.

a This parameter is set to zero because it is redundant.

Producers at home (in order of asked in the survey)

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[P_Home3 = 1,00]	-70.021	37.723	3.445	1	0.063	-143.956	3.915
	[P_Home3 = 2,00]	-69.093	37.712	3.357	1	0.067	-143.008	4.821
Location	Cluster 1: a lot of experience	-0.196	2.236	0.008	1	0.93	-4.577	4.186
	Cluster 2 : mid experience	-0.827	1.412	0.343	1	0.558	-3.595	1.941
	Cluster 3: low experience	0a	.	.	0	.	.	.
	H1.1 different sound	0.173	0.119	2.115	1	0.146	-0.06	0.405
	H1.2 better sound	-0.236	0.121	3.806	1	0.051	-0.474	0.001
	H2.1 prefer touch	0.484	0.169	8.233	1	0.004	0.154	0.815
	H2.2 requires skill	0.127	0.116	1.189	1	0.276	-0.101	0.355
	H2.3 more fun	0.062	0.156	0.16	1	0.689	-0.244	0.369
	H3.1 collecting	0.025	0.098	0.067	1	0.795	-0.167	0.218
	H3.2 more value	-0.035	0.094	0.139	1	0.71	-0.219	0.149
	H3.3 analog too expensive	-0.289	0.104	7.7	1	0.006	-0.493	-0.085
	H4.1 no screen	0.082	0.082	1	1	0.317	-0.078	0.241
	H4.3 digital functionality	-0.281	0.104	7.365	1	0.007	-0.485	-0.078
	H4.2 creative limits	0.238	0.101	5.562	1	0.018	0.04	0.436
	H5.1 Retromania	0.124	0.106	1.373	1	0.241	-0.083	0.331
	H5.2 nostalgia	0.04	0.103	0.15	1	0.698	-0.162	0.242
	H5.3 personal history	0.213	0.122	3.047	1	0.081	-0.026	0.452
	H6.1 role models	-0.153	0.088	3.032	1	0.082	-0.325	0.019
	H6.2 infrastructure	0.012	0.099	0.015	1	0.902	-0.181	0.206
	H3.4 social interaction	-0.184	0.093	3.928	1	0.047	-0.367	-0.002
	Purchase power	9.78E-05	7.94E-05	1.519	1	0.218	-5.77E-05	0
	Gender	0.204	0.723	0.08	1	0.778	-1.213	1.622
	Age	-0.036	0.019	3.608	1	0.057	-0.073	0.001

	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
1 * H2.1 prefer touch	-0.562	0.352	2.544	1	0.111	-1.252	0.129
2 * H2.1 prefer touch	-0.003	0.223	0	1	0.989	-0.441	0.435
3 * H2.1 prefer touch	0a	.	.	0	.	.	
1 * H2.2 requires skill	-0.333	0.266	1.573	1	0.21	-0.853	0.187
2 * H2.2 requires skill	0.061	0.163	0.14	1	0.708	-0.259	0.381
3 * H2.2 requires skill	0a	.	.	0	.	.	
1 * H2.3 more fun	0.79	0.414	3.637	1	0.057	-0.022	1.602
2 * H2.3 more fun	0.114	0.228	0.25	1	0.617	-0.334	0.562
3 * H2.3 more fun	0a	.	.	0	.	.	

Link function: Complementary Log-log.

a This parameter is set to zero because it is redundant.

Producers on stage (in order of asked in the survey)

Parameter
Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[P_Stage3 = 1,00]	58.978	53.752	1.204	1	0.273	-46.373	164.33
	[P_Stage3 = 2,00]	60.371	53.771	1.261	1	0.262	-45.018	165.759
Location	Cluster 1: a lot of experience	-0.264	2.431	0.012	1	0.913	-5.029	4.501
	Cluster 2 : mid experience	-0.368	1.532	0.058	1	0.81	-3.371	2.635
	Cluster 3: low experience	0a	.	.	0	.	.	.
	H1.1 different sound	0.111	0.142	0.61	1	0.435	-0.168	0.39
	H1.2 better sound	0.004	0.156	0.001	1	0.982	-0.303	0.31
	H2.1 prefer touch	0.228	0.188	1.461	1	0.227	-0.141	0.597
	H2.2 requires skill	0.293	0.144	4.149	1	0.042	0.011	0.574
	H2.3 more fun	-0.038	0.2	0.036	1	0.85	-0.429	0.354
	H3.1 collecting	0.058	0.134	0.185	1	0.667	-0.204	0.319
	H3.2 more value	0.405	0.137	8.781	1	0.003	0.137	0.674
	H3.3 analog too expensive	-0.431	0.148	8.434	1	0.004	-0.721	-0.14
	H4.1 no screen	-0.045	0.119	0.14	1	0.708	-0.278	0.189
	H4.3 digital functionality	-0.364	0.134	7.31	1	0.007	-0.627	-0.1
	H4.2 creative limits	0.244	0.137	3.198	1	0.074	-0.023	0.512
	H5.1 Retromania	0.431	0.149	8.305	1	0.004	0.138	0.723
	H5.2 nostalgia	0.158	0.139	1.286	1	0.257	-0.115	0.431
	H5.3 personal history	-0.175	0.15	1.366	1	0.242	-0.469	0.119
	H6.1 role models	-0.552	0.149	13.717	1	0	-0.844	-0.26
	H6.2 infrastructure	0.299	0.136	4.811	1	0.028	0.032	0.567
	H3.4 social interaction	-0.301	0.126	5.738	1	0.017	-0.547	-0.055
	Purchase power	0	0	2.498	1	0.114	-4.70E-05	0
	Gender	-2.646	1.294	4.184	1	0.041	-5.181	-0.111
	Age	0.031	0.027	1.318	1	0.251	-0.022	0.084

	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
1 * H2.1 prefer touch	0.204	0.479	0.182	1	0.669	-0.734	1.143
2 * H2.1 prefer touch	0.177	0.261	0.46	1	0.498	-0.335	0.689
3 * H2.1 prefer touch	0a	.	.	0	.	.	
1 * H2.2 requires skill	-0.378	0.319	1.407	1	0.236	-1.002	0.247
2 * H2.2 requires skill	-0.328	0.205	2.564	1	0.109	-0.73	0.073
3 * H2.2 requires skill	0a	.	.	0	.	.	
1 * H2.3 more fun	0.012	0.394	0.001	1	0.975	-0.759	0.784
2 * H2.3 more fun	0.138	0.281	0.241	1	0.623	-0.412	0.688
3 * H2.3 more fun	0a	.	.	0	.	.	

Link function: Complementary Log-log.

a This parameter is set to zero because it is redundant.

Appendix C: Digital content

A digital version of this work was delivered via file transfer to Marc Voigt of the Audio Communication Group.

The directory includes:

- A digital version of this work
- A separate file of the publication bibliography in the RIS format
- Digital copies of all sources used and cited
- The results of the survey: includes only the participants which completed the survey
    1. Total raw data used for describing the sample: SAMPLE_TOTAL_FILTERED .sav
    2. Data sample used for analysis of producers: SAMPLE_PROD_COMPLETED.sav
        - variables used in regression models: V1 to V23 (D_spendT to p_c_exp)
        - dependent variables: P_Home3, P_Stage3
    3. Data sample used for analysis of DJs: SAMPLE_PROD_COMPLETED.sav
        - variables used in regression models: V1 to V23 (D_spendT to D_c_exp)
        - dependent variables: D_Home3, D_Stage3