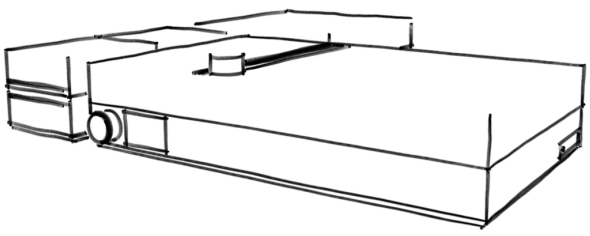

“Without music, life would be a mistake”.
Friedrich Nietzsche

Re-inventing the analog: design, from digital back to material culture
(dissertation and design project)

The Materiality of Music

Physical Sound Media - The impact of digital world to “music materiality”.

SCHOOL OF ECONOMICS, BUSINESS ADMINISTRATION & LEGAL STUDIES / SCIENCE AND TECHNOLOGY

A thesis submitted for the degree of
Master of Science (MSc) in Strategic Product Design

24/01/2020
Thessaloniki – Greece

I hereby advocate that the work submitted is mine and that where I have made use of another's work, I have attributed the sources according to the Regulations set in the Student's Handbook.

24/01/2020
Thessaloniki - Greece

Abstract

This dissertation was written as part of the MSc in Strategic Product Design at the International Hellenic University.

The research is a very insightful and informative contribution to the emerging digital world focus on the literature on vinyl records. The study combines a cultural sociological approach with insights from material cultural studies, supporting and illustrating their theoretical discussion with frequently fascinating material from several interviews.

This project investigates the reasons behind vinyl records persistence within our technologically accelerated culture & provide meticulous details as to how materiality matters in our digital world. This project focuses on establishing vinyl's status as a 'special object'. The dissertation is written with love for vinyl records, their aesthetics and the forms of social life they foster.

In the digital years we live, with the usage of smart phones and mp3 technologies, users have easily access to the global sounds. Vinyl records seek the persistence of an older technology of the consumption & production of music. Vinyl demonstrates the ways how the material objects play a significant role in our everyday lives, not only through the sound quality but also through the feeling.

Welcome to the world of the post-digital.

Keywords : Materiality, digital, physical, music, vinyls

Trimi Anna
1106170028
24/01/2020

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CHAPTER II
DESIGN

Introduction

Although we are living in a digital era, analog seems to make a big return.

Older analog technologies provide the kind of tactile physical experience that a purely digital world has started to remove.
Of course there are plenty of benefits working with media, digital platforms and files but we have to understand that we are still living in a world that analog is of great importance. In our daily life, as human beings we use to touch things, hear and see things, all of which are analog reception devices

In reality, although an increasingly large percentage of our everyday experiences can begin in digital form, within the digital domain, none of our interactions with those experiences actually occur. Instead, all of those experiences happen in an awfully high-resolution analog domain.

While it may seem weird, as our world becomes increasingly digitized, it's good to take a step back to truly notice. It's also worthwhile to acknowledge that not all technology-driven pendulums of change always point toward digital. As technology starts to grow up, it should actually start to become more analog-like.

Searching back to the history and making a deep digging to several innovations, from computers to social media and beyond, the evolution has begin with analog efforts to create or recreate certain types of information. Many of these efforts had severe limitations, though, so for everything from computer files to audio and beyond, technologies were developed to form and manipulate this type of digitalized information.

For the last few decades, there is an evolution of digital files and the huge assets in organization, anal-ysis and establishment that digital era has provided. Now, however, we're starting to see the restrictions even that digital technologies can bring in different sections like entertainment content and certain types of information.

Along this direction of technological development, many people have missed, the kind of physical interaction that human beings extremely long for as part of their existence. The final result has been the restoration of older analog technologies that provide some kind of palpable physical experience that a completely digital world has started to remove.

Chapter I
Research

CHAPTER I
RESEARCH

1. PHYSICAL VS DIGITAL PRODUCTS

Yariv Sade, April 29,2015 (http://productdesignmanagement.com)

According to a researsh of Yarin Sade, below there are some advantages and disadvantages of physical and digital products.

Physical products are an indivisible part of human history. From ancient tool makers to modern mass man¬-ufacturers, physical products were always meant to increase and advance the human body, giving us the skills to act things better, faster and stronger, in a way we wouldn't be able to do otherwise.

There are only two kind of tools that increase the human mind: writing and software. The invention of writing made humans to be able of outsourcing thoughts, ideas, and information outside of the human brain. That was one of the biggest step in our evolution as human beings. The software took these abilities a few steps further by implementing a more powerful tool to save and use information or make calculations.

Physical products and software products have plenty of differences. The first has a "body" and it follows the rules of physics, while the second has no "physic structure" and is based on logic.

For many years, these two kind of products were detached. Nowadays, the borders between them are fading out. The Internet, the Internet Of Things (IOT), Wearable Computing, and the low cost of microprocessors let on more and more physical products to also become software products.

Below i will analyse some terms, which are certaintly connected with the similarities as well as the differences between physical & digital products.

1.1 User Experience

The terms user experience (UX) and user interface (UI) are relevant to software products. Physical products are assumed to have only "ergonomics." For both software and physical products, the UX & UI are important and should be a basic aspect of product design. (Yariv Sade, April 29,2015)

1.2 Structure

In most cases, a structure of a software product is much more perplexing than a physical product's. Normal-ly, in software products there are many practicing options and usage alternatives. Software products are constructed using a high level hierarchy whereas physical products are flat.
(Yariv Sade, April 29,2015)

1.3 Comprehensiveness

It is easier to appreciate a physical product rather than a software product. Someone can see the entire physical product at once and understand how it is constructed. In the case of software products someone can¬not understand the whole product at once. In order to comprehend a software product, the user have to analyze its internal structure. (Yariv Sade, April 29,2015)

1.4 Senses usage

The use of software products is made through screens. User interaction with software products is achieved by two human senses: sight and hearing. This is the main reason why software product design only considers these two leading senses. In the case of physical products, touch and smell can add a lot of information and upgrade user experi¬ence. Some of the most important aspects of physical product design are weight, temperature, texture, tactile feedback, and smell. (Yariv Sade, April 29,2015)

1.5 Integration

Software products are created by using a certain programming language. They can be run on certain devices, with certain screen sizes and certain operating systems. On the other hand, physical products can be stand alone or need very simple connections. In this matter, software products are more complicated to develop. The product development process has to take into consid¬eration parameters and restrictions. (Yariv Sade, April 29,2015)

1.6 Production

There are plenty of differences in production between physical and software products. For physical products, production means transforming the design to a mass production by creating a production line. Between a physical product's final design and a ready-to-use product there is a lot of work and difficulties. For software products, "production" means maintaining the system by enabling users to log in in order to use the product. (Yariv Sade, April 29,2015)

1.7 Bugs

"Bugs" in software products is like a "failure" in physical products. These are problems in the product design, that indicate that something doesn't work as it should. Due to the complexity of the structure of software products, it is much harder to find bugs compared to physical product's failures. On the other hand, sometimes it is easier to fix software "bugs" compared to technical failures. (Yariv Sade, April 29,2015)

1.8 Sizes and Dimensions

We live in a 4 dimensional space-time world, built on three physical dimensions and one time dimension. Somehow, physical products are more relevant to the three physical dimensions, and software products are more connected to the time dimension. Physical products do not change in time and software products do not change in space. (Yariv Sade, April 29,2015)

1.9 Upgrades

One last aspect between the physical and the digital is "upgrading". Physical products typically leave upgrading to the end user to do on their own, with their own resources. On the other hand software products in most cases can only be upgraded by the maker of the product. (Yariv Sade, April 29,2015)

2. DIGITAL DISTRACTION

Digital evolution has great impact to human beings, ecpecially the internet of things. The development of people's relationship with technology is huge and the tech addiction is of great importance. As a specific and most accurate example of analyzing this chapter, i will use the smartphones.

The arrival of the smartphone has meant that we can have the Internet with us wherever we go: something that is hard to refuse. There's a lot of interesting stuff, plus a whole lot more that's quite dull but is still capable of owning our brains through smartphone addiction.

Ten years ago, smartphones were still very unusual. Now, it seems to be the opposite. Ten years ago, most people had mobile phones, but they would generally only attract our attention if someone had decided to call us or send us a text. Now that most people's lives are so much more automated: the new normal is to scurry around within a ceaseless onslaught of status updates, push notifications and a whole lot more. *(The Punkt. Digital Detox Challenges, www.punkt.ch)*

But how would be life without so many digitilized products? Should we have a digital clean-up?
The digital world has many benefits for us, but only when we're in charge. We have to control the technology. When we let ourselves be led astray, become seduced by these digital 'helpers', things get dangerous.

The demands of modern life make us feel that we need to be online all the time. It's time to create some healthier boundaries in our relationship with technology, for a better quality of life.

"Multitasking is a myth; we don't do things as well when we do more than one thing at a time, whatever it is. But avoiding distraction these days is tougher than we think; even when we are driving, which requires perceptual skills, we are often working at the same time. By dividing our attention, our labour increases and the results for our efforts are more mediocre. And that applies to me as much as anyone else: I notice this when I try and do more than one thing at once. Focus gives better results". *(Petter Neby, founder & CEO of Punkt)*

Not all digital products and services are correct and helpful. With the Internet at our fingertips, we forget how easy it is to outsource our brains to phones. Choose a restaurant, get directions, ping a friend, go on a date, select some music, download a health app and when in doubt, ask Google.
Looking out of a window, sitting on a city bench, chatting to strangers, asking for directions, or getting lost can be great opportunities for serendipity and human interaction. Even boredom, something we avoid more and more with smartphones, is essential for creativity. Autonomy may atrophy if we become too reliant on smartphones to do everything for us. *And autonomy is an essential part of human well-being.*

Before the smartphone, real life connections helped people develop skills and opinions of their own – and perhaps even a stronger sense of belonging in the world. *(www.punkt.ch)*

Life is too short to keep our heads down.

3. MATERIALITY & CULTURE

3.1 Cultural heritage exhale through digitalized world and the internet

In the last decades the protection and promotion of cultural heritage (in the form of monuments, historic sites, artefacts and more recently cultural expressions) has become an essential issue of European and international cultural policy.

"Since the end of World War II, UNESCO has been a key organization in defining cultural heritage and ensuring its protection through the adoption of a series of conventions, financial and administrative measures. Parallel to the work of UNESCO, governmental and non-governmental organizations, professional associa¬tions and academic institutions around Europe have been involved with documenting and providing access to different forms of cultural heritage (ranging from archaeological sites and natural parks to museum col¬lections and folk traditions). In this process, a significant body of resources dealing with the documentation and promotion of cultural heritage through different technologies has been developed".
(UCL Institute of Archaeology, London WC1H OPY UK, m.alivizatou@ucl.ac.uk)

In the past two decades, digital technologies have dramatically changed the cultural scene. There are new forms of creation, production, distribution, access and participation, that have remodeled industries, such as book publishing, music and films. These changes have brought both opportunities and innovations, in a process that has affected both the Global North and South. For example, virtual Museums offer visitors the possibility to experience objects or sites inaccessible to the public.

I strongly believe that the use of digital images for research is so ubiquitous in every kind of historical inquiry that it's taken for granted, but it's surprising how little we've interrogated the implications of using these images instead of the actual material objects for our research. Though the idea of the virtual museum goes back nearly as far as our common use of the web, or even to the time of CD-ROMs, in the last few years the production of digital images of historical objects has exploded. As server space, consumer tools, and institutional missions have rapidly evolved, we've seen a mind-numbing escalation in the absolute volume and variety of images we can easily obtain.

For historians, it's been an undeniable benefit that we've been living with access to vast quantities of images for about a decade. High resolution images of historical newspapers, paintings, archaeological finds, textiles, tools-the whole wealth of material culture on which so much first-hand research has relied-has been scanned and uploaded to the web for our use.

"Another example is that it is clear that new technologies signify big advantages in terms of access to culture. First of all, digital distribution allows countries to communicate to each other. Books, music and cinema can reach every corner of a country much more easily than in the past. This is particularly useful for large countries with difficult access, for example rugged terrains. Moreover, considering that we live in a time represented by the proliferation of increasingly affordable smartphones, digital access to cultural services is facilitated considerably".
[The benefits of new technologies in terms of access to culture are underscored in the reports of Argentina (2012: 4, 9, 15, 16 pp), Ecuador (2012: 13pp), Mexico (2016: 3pp) and Spain (2016: 31, 66pp)]

New technology can be used not only for the digitization of cultural expressions but also in terms of cultural communication, education and community development. Although technology cannot re¬place human interaction, it can still support cultural transmission in innovative ways.

One example is facial expressions. Facial expressions are one of the most persuasive way for humans to communicate emotions and affective states, to clarify, to signal, to interact with the environment and other people. (Zafeiriou, S. and Yin, L. (2012) 3D facial behaviour analysis and understanding, Image and Vision Computing, vol. 30, October, pp. 681-682.)

4. MATERIALITY AND MUSIC

4.1 Physical media

Older people experience and consume music through behavior "orientated to tangibility." Younger audienc¬es, what i call the digital generation, "see music as a freely floating object, accessible at any time or place" (Hoklas, 2014). This is a model of music where rapid access becomes an indicator of progress. While listeners now have the advantage of carrying gigabytes of data, the digital clarification of music indicates a blight of physical scenes (record stores, underground raves, etc.), where music was once a form of collective ritual.

The Internet encourages planetary networks of automatic music dissemination rather than localized configurations. This decay of physical scenes coincides with a shift away from physical media. What is lost is the palpable trace of artistic production: the grooves on the record, its individual scratches, the artist collectives and the buildings they inhabit, the rooms where their music is written and recorded, the care necessary to maintaining instruments and objects, etc. The Slow Media Manifesto, written by Jörg Blumtritt, Benedikt Köhler, and Sabria, is a 14-point manifesto which advocates slow media formats such as CD players, record collections, cassette decks, printed text:

"2. Slow media promote Monotasking. Slow Media cannot be consumed casually, but provoke the full concentration of their users.

5. Slow Media advances Prosumers, i.e. people who actively define what and how they want to consume and produce. In Slow Media, the active Prosumer replaces the passive consumer.

9. Slow Media are distributed via recommendations not advertising: the success of Slow Media is not based on an overwhelming advertising pressure on all channels but on recommendation from friends, colleagues or family.

11. Slow Media are auratic: Slow Media emanate a special aura. They generate a feeling that the particular medium belongs to just that moment of the user's life" (Köhler, David, Blumtritt, 2010).

The elimination of presence is related to the metaphysical destruction of material objects, their erosion in value as they are moved from the real to the virtual.

The modern concert space for music is now a hybrid space, where the audience locates the venue but also is living mentally in the virtual space, developing images on their smartphones which will propagate the web and create a record representation of the event. The audience may find themselves more involved with their online social appearance as a participant of the certain concert and less involved with the real event itself. These habits demonstrate a kind of retiring of the brain, where younger generations face the concert as an event to be docu¬mented and shared, rather than an experience to be lived.

Many people are rejuvenating older analog technologies like printed books, vinyl records, musical instruments, that provide a kind of palpable physical experience that a completely digital world has started to eliminate.

In the case of vinyl records and turntables, as being someone who has an original collection of vinyl records, I totally appreciate the potential of an analog audio experience. As the time goes by it is extremely easy to forget how good the audio quality on a decent turntable and sound system can be. It took a recent experience of someone spinning vinyl at an event I attended to remind me how good it could still sound.

Musicians have always captivated by the feel and touch of particular instruments, and as our digital devic¬es become the common instruments of our age, there's something to be said for the quality of the tactile experience they can provide.

Plus, in the case of musical instruments, one of the biggest trends over the last several years has been the enormous popularity in knob-based, physically controlled analog synthesizers.

MATERIALITY AND MUSIC

4.2 Live Performances and Individuality

Image-driven consumption of music events reduces the overall experience to an individualist sense.

Performances once marked by ecstatic ephemerality are constantly captured up to the point where the original ones are not any different from their reproductions. The music scene used to be a meaningful space of collective ambience where artists, musical instruments, drum kits, records, audience converge into a common aura. However, the scene is significantly reduced nowadays to a background element. The audience is reduced as well, from a former dynamic crowd of engaged viewers, with potential of collective consciousness, to a mass of disconnected individuals. Several companies offer live VR (virtual reality) performance, which is an experience characterizing that trend towards technological individuality. Music spaces are transformed into disembodied zones while those companies try to endlessly innovate. Famous architectural firms, such as Stufish, attempt to integrate "Instagram moments" into designs, where concert crowds use their phones to digitally stream the show. Beyond a digital engagement, this approach works as free marketing as well.

The so called Instagram moment affects live performances which "diverse into visibility" and alter the "madly charged present of live moments". The "here and now" sense of a concert is crushed in a world where the "where" aspect is lacking. Physical products belong to a place in comparison with the digital images that are not related to any real topology.

pexels.com

pexels.com

pexels.com

MATERIALITY AND MUSIC

4.3 Virtual musical instruments–natural sound using physical models

Physical modelling is a new approach to sound composing using computers. The term refers to software that recreates the techniques of analog musical instruments in order to produce sound. The main idea is the following: the vibrating structure of an instrument is simulated in a way that the product sound (by the model) is identical to the sound of the original physical object. Thus, a musical instrument is being modelled with mathematical and physical formulae in a computer program. These formulae are realized by the computer to produce the final sound. (VESA VALIMAKI and TAPIO TAKALA, Organised Sound: 75–86pp1996 Cambridge University Press)

Consequently, a software generates numbers (samples) that can be processed as computer music fans understand. A digital signal, which is a sequence of digits, propagates into a digital-to-analogue (D/A) converter, translating digits to the corresponding electric voltage levels. This time-varying voltage is then amplified and transmitted via loudspeakers or headphones. Each stage of this synthesis process, except the initial creation of the digital signal, is essential since the early days of computer music. The method used to produce the final sound in the physical modelling algorithms is what differentiates this synthesis approach from previous ones. (VESA VALIMAKI and TAPIO TAKALA, Organised Sound: 75–86pp1996 Cambridge University Press)

Therefore, the physical modeling software imitate the properties of the sound source, while the older synthesis techniques focus on the properties of the sound signal (waveform, frequency spectrum, filtering, etc). Surprisingly, none of the earlier music synthesis methods really considered the physical sound source object, since they used digital oscillators or noise sources. However, in the field of speech synthesis, the sim¬ulation of a sound source has been popular since the early 1960s (VESA VALIMAKI and TAPIO TAKALA, Organised Sound: 75–86pp1996 Cambridge University Press).

The first commercial products implementing physical model were released recently, including the Yamaha VI, Korg Wavedrum and Roland VG8 guitar processor. Among them only the VI is a purely physical model while the rest use sound processing algorithms, inspired by principles of physical modelling.

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MATERIALITY AND MUSIC

4.3.1 Sound synthesis techniques

Based on my knowledge on music synthesis, below i will demostrate some techiques of sound synthesis in order to understand some of the recent modelling algorithms.

-Linear and nonlinear techniques
In prior days, sound union systems were generally isolated into two categories according to linearity. An acoustic system is said to be linear if the most of outputs produced by two diverse input signals is the same as the output signal produced when the sum of these two signals has been used as an input, and the amplification of the input signal by some factor causes the output to be scaled by the same factor. These are known as the principles of superposition and homogeneity, respectively. Every one of the systems that don't fulfil these standards are called non linear. SSome fundamental highlights of nonlinear systems are that the output signal may contain other frequencies than those present in the input and that the spectral content of the output signal relies upon the amplitude of the input signal.

-Wavetable synthesis
Another exceptionally famous procedure is sampling, also called wavetable synthesis. It means recording, handling and playback of sounds. While it can be argued that sampling is not a synthesis technique at all (since it does not create sound from scratch) it must be said that this system offers an infinite assortment of potential outcomes: any sound can be recorded digitally, filtered or edited or joined with different signals, and finally the processed version can be tuned in to.

Smith (1991) suggested another classification for sound synthesis techniques into four categories:

"(i) unique calculations, (ii) handling of recorded samples, (iii) spectral models, and (iv) physical models. The first class incorporates strategies that produce sound dependent on some scientific equation which has no immediate connection to true sounds or acoustic principles of sound generation. Thus it is difficult to predict what kind of sound is produced by a particular algorithm, or to design an algorithm that results in a particular sound" . *(Smith, J. O. 1991. Viewpoints on the history of digital synthesis. Proc. 1991 Int. Computer Music Conf. pp. 1–10. Montreal, Canada.)*

4.3.2 Physical modelling techniques

The methods used for physical modelling can be divided into five categories:

(i) source–filter modelling, (ii) numerical solution of partial differential equations, (iii) vibrating mass–spring networks, (iv) modal synthesis, and (v) waveguide synthesis.

The source-filter strategy is incorporated here because it can in some cases be interpreted as a physical modelling method. An example is a vocal tract model that is used for synthesising speech or singing: the intermittent pulses generated by the vocal cords are the source and the vocal tract is the filter *(Rodet 1984)*.

In some instruments it is likewise simple to isolate the source and the filter. In numerous percussion instruments, for instance, the excitation is a short impulse that iisn't influenced by the feedback from the resonator. However, most instruments are more complicated systems than just only a blend of two subsystems. In wind instruments, for example, feedback from the resonator to the excitor is required, and moreover the interaction of the excitation system and the feedback signal is nonlinear.

The first attempts to utilize a physical model for for creating melodic sounds were made by Hiller and Ruiz *(1971)*. They began with the differential conditions that oversee the vibrations of a string and approximated this condition with finite contrasts. This procedure is computationally serious. Indeed, even today ongoing sound synthesis with this approach using moderate hardware is not feasible. *(Chaigne 1992)*

Later during the '70s another approach to physical modelling was taken in Grenoble, France. A framework called CORDIS was created which simulates an instrument an assortment of point masses that have versatility and frictional qualities*(Cadoz et al. 1984, Florens and Cadoz 1991)*. This approach is firmly identified with the so-called finite element method(FEM) that is used in mechanical engineering to reproduce vibration of structures. The object is separated into countless pieces in space. Every piece is associated with its neighbours with springs and microdampers. These elements form networks that act like the vibrating object. Toward the start of the 1980s a special-purpose processor was was assembled which empowered real-time sound synthesis based on physical modelling to be acknowledged for the first time *(Cadoz et al. 1984)*.

At IRCAM (Institute for Research and Coordination in Acoustics/Music) in Paris a third technique for physical modelling was developed *(Adrien 1991)*. It is called modal synthesis and depends on a portrayal of a vibrating structure as an assortment of frequencies and damping coefficients of reverberation modes and directions that describethe mode shapes. At the point when the instrument is excited, this force excites some or all of the modes. An advantage of modular synthesis is that analysis tools exist which are not toolaborious to utilize. For some easier structures, for example, a string, the model information can be processed in a scientific structure. In modular synthesis, one of the issues that has to be solved is where to take the output of the model. At IRCAM a clever solution was found using the body of a real instrument as the 'amplifier': on account of the violin, for instance, this implies the reproduced vibration of strings is sustained to electrical shakers that are appended to a violin body, the strings of which have been deliberately damped. *(Adrien 1991)*

4.3.3 The usage of virtual instruments

In the future, more advanced synthesizers are expected to exist, which will specifically be commercial applications of physical modelling. Computer music professionals, compos¬ers and arrangers of acoustic music will supposedly welcome them since they offer the possibility of listening to music in progress before any rehearsal by professional players. Even nowadays composers use a MIDI synthesizer to create and listen before introducing any piece to musicians or other listeners.

The realistic synthesized sound of physical modeling can make an electronic premiere sound as real as naturally performed using acoustic instruments. At the time that physical modelling reaches high accuracy in simulation of structures, it will be even possible to simulate not existing virtual musical instruments, which might be physically feasible but never actually created. This could be a tremendous feature for instrument creators too, with infinite opportunities to improve or modify any existing acoustic instruments. Because typically creators have to rebuild a prototype various times in order to test whether a modification yields the expected result. "*Computers already support the design process of instrument components, e.g. the finger holes of wind instruments"(Keefe 1982).* Complete simulation and sound syn¬thesis are coming as parts of a holistic approach. *(Keefe, D. H. 1982. Theory of the single woodwind tone hole. Journal of the Acoustical Society of America 72(3): 676–87)*

Restoration of historical musical instruments is another field of application. When analysis and parameter optimization reaches a point that a physical modeling algorithm can simulate the analog recording of a tone, any recordable instrument could be simulated. For example, antique violins which do not exist anymore could be recreated.

Furthermore, past recordings with destroyed parts could be restored by replacing the missing information using the physi¬cal model of the exact old instrument. Of course, the ethical suitability of such a process may be debatable. But still, researchers in digital music and physical modelling envision a new way of producing music, instead of traditional recording and storing the recorded sound samples.

Record sound digitally and analyze it with a computer program that performs two tasks:

- Estimate the parameter values for physical models of the sounds present in the performance. Since separation of sound signals in the same recording is cumbersome, it may be optimal to record some isolated tones from each instrument for a sufficient analysis.

- Scan the music signal through time and estimate the time variations in the so-called control parameters of an algorithm. These changes usually correspond to change of notes, velocity, playing style, or human behavior (due to musicians).

Virtual reality is a domain where structure and behavior of real or imaginary worlds are modelled and animated. Utilizing special devices like head-mounted displays, an observer can be provided a virtual environ¬ment as realistic as being inside the simulation. Most research so far is focused on de¬veloping 3D interaction devices and pragmatic visual effects. However, sounds in virtual worlds have recently gained public interest *(Begault 1994).* While the visual animation of virtual objects is often physically simulated, to achieve the most lifelike sense, it is unavoidable to use the same principles for sound reproduction. *(Begault, D. R., 1994. 3-D Sound for Multimedia and Vitual Reality. Cambridge, MA: Academic Press)*

Significant similarities can be highlighted in the methods used:

Pentland and Williams (1989) applied modal analysis to represent visible deformations and vibrations of colliding objects. *(Pentland, A., and Williams, J. 1989. Good vibrations modal dynamics for graphics and animation. Proc. SIGGRAPH'89. Computer Graphics 23 (3): 215–22.)*
Terzopoulos et al. (1987) applied the mass-and-spring models (fundamental in studying Physics) for the same purpose. *(Terzopoulos, D., Platt, J., Barr, A., and Fleischer, K. 1987. Elastically deformable models. Proc. SIGGRAPH'87. Computer Graphics 21(3): 205–1).*

Gaver (1994) designed sound effects for user interfaces (also known as auditory icons) based on simulated collisions, e.g. when objects break into pieces. Concurrently, the synchronization of animation and sound effects is an area of active research. *(Gaver, W. W. 1994. Using and creating auditory icons. In G. Kramer (ed.) Auditory Displays. SFI Studies in Sciences of Complexity, Proc. Vol. XVIII, pp. 417–46. Reading, MA: Addison-Wesley).*

Additionally, Takala and Hahn (1992) outlined a pipelined process architecture in order to produce sounds similarly to photorealistic images which can be rendered by 3D CAD (Computer Aided Design) models. High-quality sound and images cannot be rendered in real time, due to computational limitations. However, it remains essential during productions of animated films. *(Takala, T., and Hahn, J. 1992. Sound Rendering. Proc. SIGGRAPH'92. Computer Graphics 26(2): 211–20)*

A simplified interactive system can still be developed, where the user can hear the effects of his/her actions on virtual objects, including essential parameters such as the direction and delay of the sound event *(Astheimer 1993). (Astheimer, P. 1993. What you see is what you hear – acoustics applied in virtual worlds. Proc. IEEE Symp.on Research Frontiers in Virtual Reality, pp. 100–107. San Jose, CA)*

We may expect soon to experience a virtual concert hall where virtual musicians play virtual instruments.

MATERIALITY AND MUSIC

4.4 Composing from Materiality

Materiality is a target on how the tactile material of an object behaves in performance. Often this happens in relation with a human performer, so we can refer to both the human agency of the performer playing an instrument (taking decisions on how to control energy into the instrument), but also the material agency of an instrument responding to that input. Material is not neutral. As Bruno Latour (French philosopher) says, “in order to accept a force we must cooperate with it. It can never be punched out like sheet metal or poured as in a cast”.

To some extent, while focusing on material aspects and according to the intangibility of music, it is a perspective that leads to an essence of issues at the heart of music as a cultural form. One example is popular music, that leads to the development of a mass market for music, which is indivisible from the gap between music as played and directly experienced and music as represented in/on an artifact that could be distributed through an expanding variety of digital media. Cultural assets simply “appear” where they do by coincidence. There are some important questions thus, related to when, why, how or with what consequences, people are bare to certain music-bearing artifacts. There are many aspects, supporting that spatial distribution of music formed by new technologies, provides an opportunity for cultural studies in order to bring distribution to the center of the study of media. (Jones 2002, 231)

MATERIALITY AND MUSIC

4.5 The Changing materiality of music

The obvious and strong connection between a melodic portrayal and it's sustaining materiality is progressively distabilized. Yet, contarry to what seems to be the drift of much contemporary commentary, music as as a social structure has not become disembodied but rather woven into and out of an extra scope of gadgets and appliances: personal computers, mp3 players as well as several new "Hybrid" forms.
(Conrad Mewton, Music and the internet Revolution,London, 2001, p.25)

A large number of these innovations have risen in the wake of web based practices of listening and distribution.While these new innovations in various ways influence meaning-producing aspects related to the actual reproduction of the melodic content, some of the more profound changes appear to identify with parts of storage and distribution.

Such changes have traditionaly played an important role within frequent cultural and social trajectories connected to the accessibility and portability of mainstream music. Despite the fact that these trajectories in several ways also have been related to changes in the style and ynthesis of the music itself, what follows is an effort to demacrate, within these paths some of the social/cultural issues related to reception as these are influenced by the growing instability of the relations among content and media. (Henrik Bodker, The changing materiality of music,Denmark, 2004, p.25)

According to all the information above, it can be argued that much music is used, and thus gains meaning related to both succession and a larger body of artefacts- what one hears partly becomes significant because it has been picked among an assortment of choices. The second reason is that albeit new, digtal distribution channels have opened up through the internet, most usages of new storege media will occur according in relation to existing forms of storage, accumulations of fundamentally sound CDs.

To conclude, what we see at that point is to an enormous extent content existing on conventional storage media moving unto or into various sorts of gadgets, and the social and cultural implications. In the most significant and formal terms, the changing materiality of music is established on the transformation of the melodic portrayal from analogue engravings to the digital form of the twofold alphabet. While this happened as of now at some point during the 70s with various changes identified with the producton of music, the changes concerning consumption innovations started with the audio CD in the early 80s, and turned out to be progressively relevant up through the 90s with the ability, via computers, to separate and recreate, the musical content, in digital form, from the industrial artifact, the CD, without decreasing the quality.

MATERIALITY AND MUSIC

4.5 The Changing materiality of music

4.5.1 Materiality through record stores

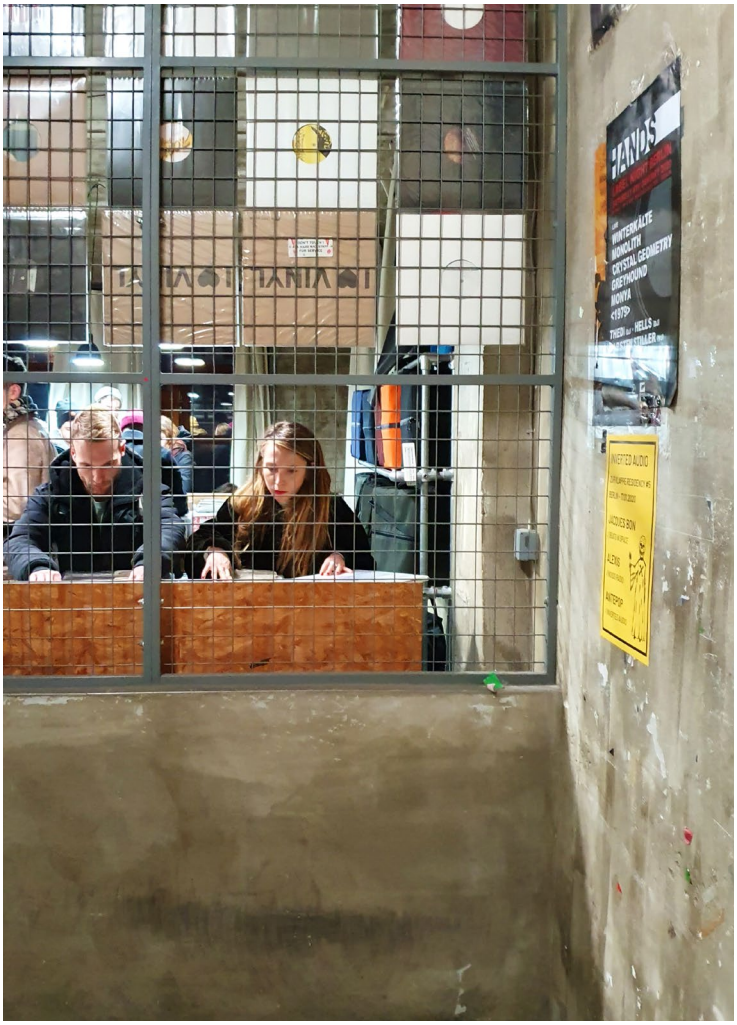
Record stores were gathering places for those who rushed to hear the most recent releases, anticipated getting the guidance of assistants and stayed nearby people who reinforced over tunes and artists. Good record stores had a magical atmosphere. The early ones -those in the late 1930s and '40s, were thin and cramped. In the 1970s, they kept getting bigger and bigger and the owners bragged about their size and selection. Tower Records in Los Angeles would advertise itself as the largest record store in the known world.

Fundamentally every store was the same: bins with alphabetized Lps, Cds, and tapes arranged by category with featured items at the end of the rack. The lighting was usually too bright and the dust level potent. The personality of the store was determined by the art on the walls, the handful of obscure artists promoted with displays, the music on the sound system, and, of course the attitude and knowledge of the sales clerks. Even in a generic mall, there would be differences between record stores, much more so than between clothing emporiums.

'I spent a summer in Italy going to every record store...searching for a 45 of 'Questa Volta' by the Yardbirds. I was the kid who was invited to parties because i had the records." -Bob Merlis, music industry executive (Record Store days, Gary Calamar & Phil Gallo, Editor Scot Calamar, 2009, Sterling NY, p.7)

Record stores make your personal journey with music even more personal. You feel the music, you touch it. If this is not about materiality , then what else could be?

Photographs from Doctor Vinyl Record Store, Brussels 2019, personal collection



Photographs from Hardwax Record Store, Berlin 2019, personal collection

Chapter II
Design
Part 1 - **VINYL RECORDS IN A DIGITAL ERA**

CHAPTER II
DESIGN

1. VINYL RECORDS IN A DIGITAL ERA

1.1 Streaming services vs record discs

According to a research of BBC :

Only 32 million CDs were sold in 2018 - right around 100 million less than in 2008; and a drop of 9.6 million year-on-year.

The development of vinyl additionally started to level, with 4.2 million records sold, an ascent of simply 1.6%, said the BPI.

Contracting shelf space in general stores added to the log jam, however HMV's difficulties propose we are progressively uninterested in owning our music.

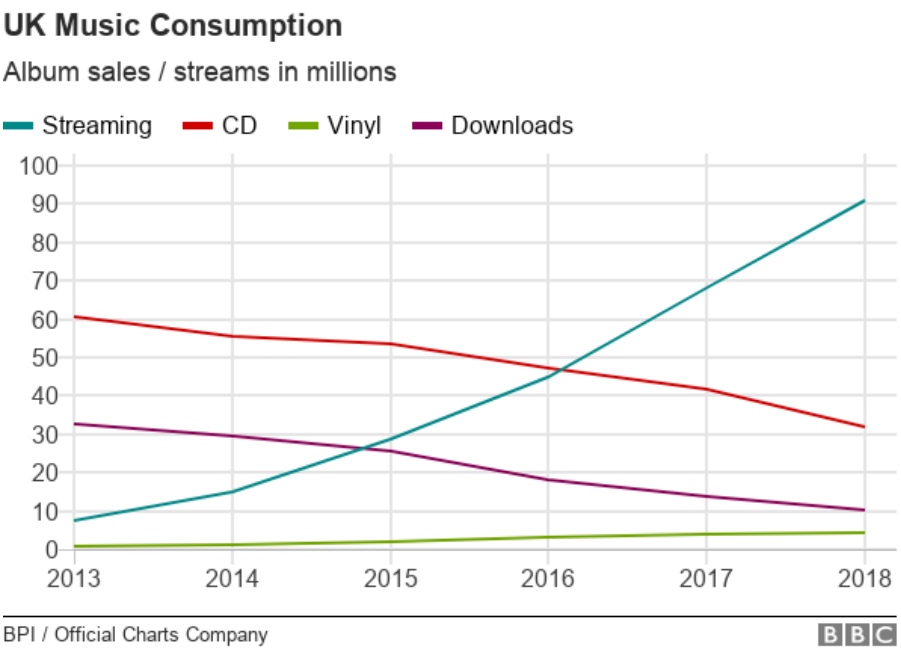
The CDs that did sell in large quantities tended to appeal to older, non-traditional music buyers - with six of the year's top 10 albums either film soundtracks or now compilations.

"Lots of us have changed the way we consume music and film, and more people are streaming from Netflix or Spotify," Kim Bayley of the Entertainment Retailers Association recently told BBC Radio 5 Live.

"We all use Spotify but I think we all value vinyl," he told BBC News.

"We've spent a lot more time talking about how we put our vinyl out than we have done about how we're going to stream our songs.

"We will literally talk about the weight of the vinyl, the presentation, the quality of the cut - all that stuff. People don't know how important it is to us."



"I definitely believe the next decade is going to be streaming plus vinyl - streaming in the car and kitchen, vinyl in the living room and the den. Those will be the two formats. And I feel really good about that." Kim Bayley

www.bbc.com

1.2 The impact of streaming to the environment

In the height of the digital age, streaming may seem like the furthest we may ever advance in terms of listening to music because it's simple, it's easily available and it's considerably more affordable than the most services.

These convenience factors may appear to be tempting, however, by no means is streaming music a more feasible green alternative to the ever-dwindling physical music format?

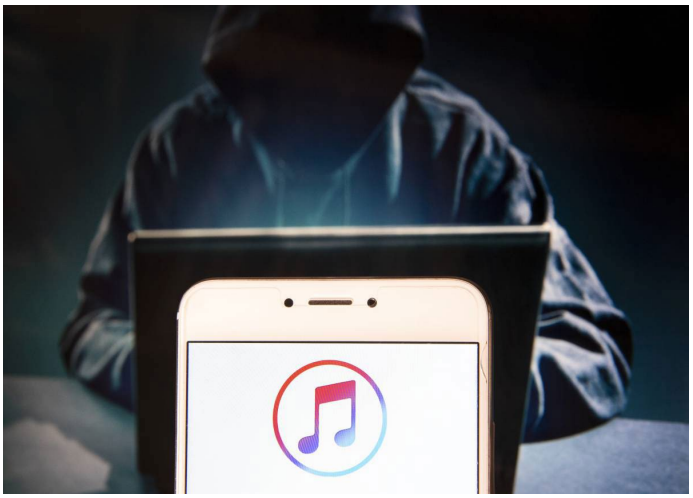
As indicated by "*The Cost of Music*', a joint study penned by the University of Glasgow and the University of Oslo says that listening to music online takes more of a toll on our environment than it does to actually create physical music, whether that be CDs, cassettes or vinyl LPs.

Major digital platforms like Spotify, Itunes, Tidal and SoundCloud are controlling the industry not only because they're affordable, but because the age of an album is essentially no more.

In the digital age, Top 40 radio hits and Billboard charts comprise typically of singles and highlights only which renders a majority of new albums obsolete.

A considerable amount of such singles are released exclusively to digital platforms, which doesn't even allow for an different listening way.

The beauty of streaming is that it provides listeners with the latest music so easily, as opposed to physical albums which have high cost as well as restrict the listener to what they're listening to.



iTunes logo is seen on an Android mobile device. Miguel Candela / SOPA Images/SOPA Images/LightRocket via Getty Images

As a result, streaming has paved the way forward for a massive amount of music listeners, especially young ones.

Unfortunately these listeners, however, are accidentally help to increase greenhouse gas emissions ,according to the recent study.

Before the digital age, plastic consumption was one of the greatest concerns in how music affects the environment. But now, more than ever, the industry is contributing an uncommon amount to climate change.

While vinyl, tapes and CDs utilized tons of kilograms in plastic to be created since the 1970s, that usage has almost doubled as a result of streaming.

The generation of electricity required to store, transmit, download and stream music digitally has produced greenhouse emitions at a high level.

An associate professor in music from the University of Oslo, Dr. Kyle Devine, said, *"These figures may suggest that the rise of downloading and streaming is making music more environmentally friendly. But a very different picture emerges when we think about the energy used to power online music listening."*

Storing music online uses a huge amount of resources and energy," he added, which higly affect the environment. From a plastic pollution view, the good news is that overall plastic production in the recording industry has diminished since the peak of vinyl.

From a carbon emissions perspective, however, the shift towards streaming recorded music from internet-connected devices has resulted in dramatically higher carbon emissions than at any previous point in the history of music.

Danish vinyl store Route 66: one of many independent record stores that take part in the worldwide event Record Store Day in Copenhagen, Denmark, on April 21, 2018. Malthe Ivarsson/PYMCA/Avalon/UIG via Getty Images

"The Cost of Music" stimulates listeners to find other ways of listening to music. "We hope the findings might stimulate change toward more responsible consumption choices and services that remunerate music creators while diminidhing environmental impact," said Dr. Brennan.

While streaming cuts down significantly on plastic consumption, not only music, but movies and video games as well, it unintentionally creates more greenhouse gases by consuming more energy in the long-run.

1.3 Back to materiality

Researh of Recording Industry Association of America.

Sales from individual tracks downloads have been falling with no end in sight, thanks to the accesibility of streaming options like Spotify and I tunes. Another report, however, clarifies exactly how few people these days will buy individual digital tracks. Because there are so few of them, they were outnumbered in 2018 by people who prefered old-school style and bought actual compact discs and vinyl records.

“According to the Recording Industry Association of America, total download sales in 2018, for which iTunes led the pack, dropped almost 30%, to a little more than $1 billion. Purchases of full album downloads likewise fell, by 25%.

Sales of physical media including CDs and vinyl, according to the RIAA’s new report, were down 23 percent but totaled $1.15 billion, thus edging out digital download sales.

Another interesting thing from this report is that music fans bought almost $420 million worth of vinyl in 2018, which Cult of Mac notes in a piece today is almost as much as people spent buying album downloads from iTunes last year”.

Nowadays it is noticed that more and more people buy physical CDs and vinyl than songs on iTunes.

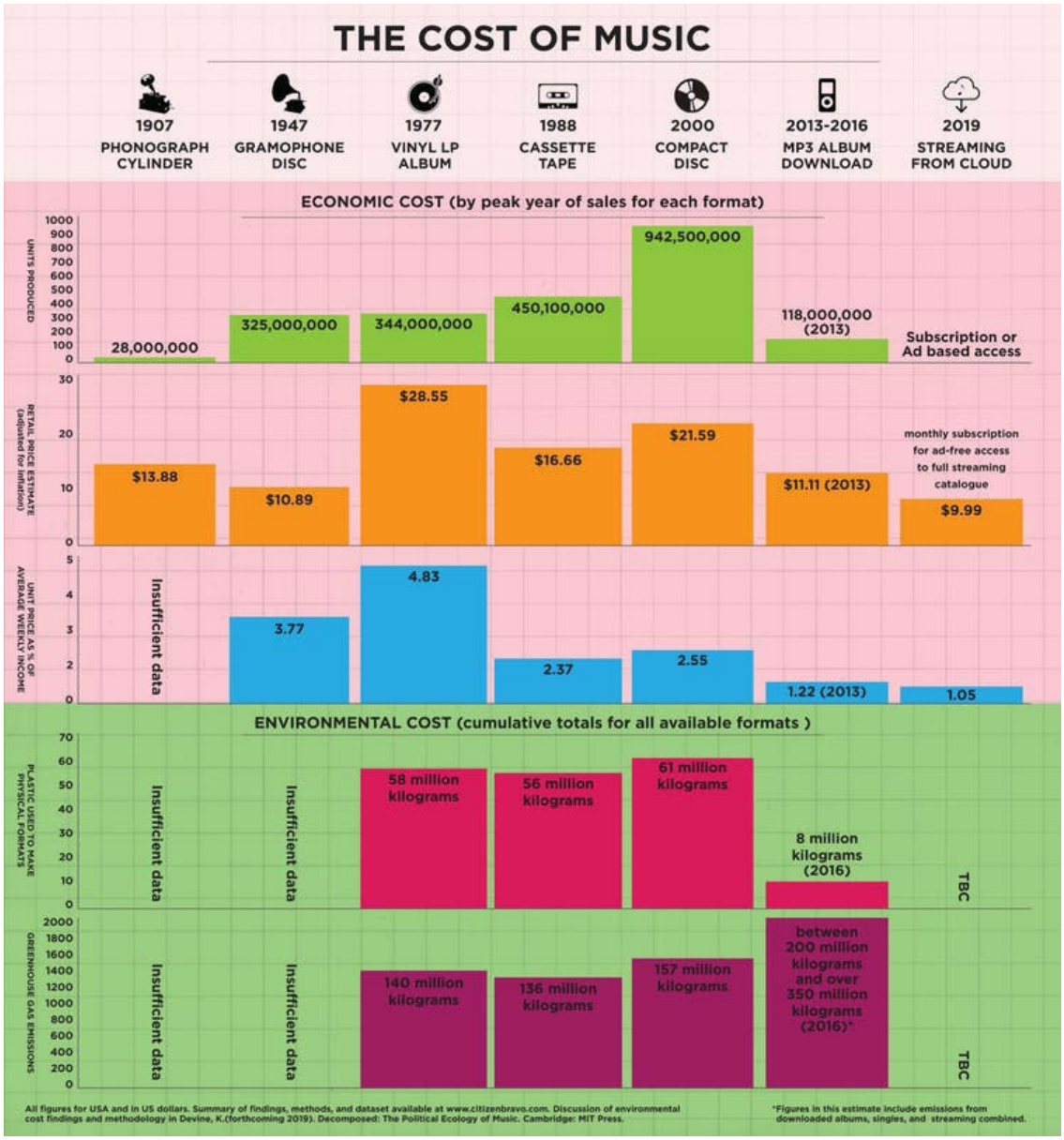
Vinyl has enjoyed another surge in sales from 2016 (Rex)

The purpose of this section is not to ruin one of life's greatest pleasures, but to to urge customers to turn out to be progressively inquisitive about the decisions they make as they consume culture.

Are we rewarding the artists who make our favourite music in a manner of accurately reflects our appreciation?
Are streaming digital platforms the most appropriate business model to facilitate that exchange?

Is streaming music remotely from the cloud the most appropriate approach to listen to music from the perspective of environmental sustainability?

There are no easy clarifications, however taking a moment to consider the costs of music and how they have changed all these years, is a positive development.



Matt Brennan/Kyle Devine

1.3.1 Vinyl Revival

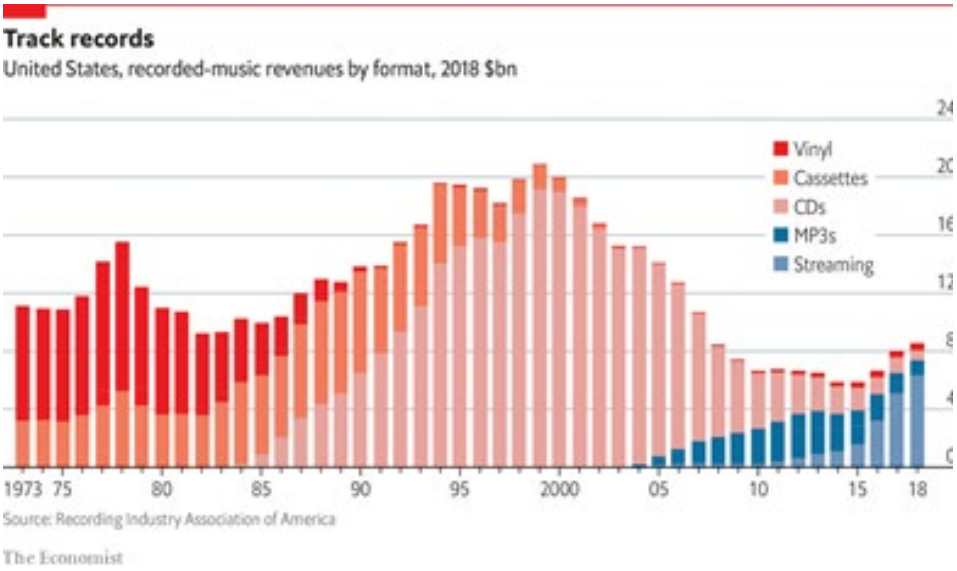
According to an article of echonomist:

" THE LP WILL be around for a good long while," Patricia Heimers, a spokeswoman for the Recording Indus¬try Association of America (RIAA), told the Associated Press in 1989. Ms Heimers' prediction may then have seemed tin-eared. Sales of cassettes and CDs already far outstripped those of 12-inch glossy black platters. In the 1990s vinyl almost vanished altogether. In 2005 a mere $14m-worth of records were sold in America. But like an ageing rocker, vinyl is making a comeback. In 2018, the first half of the year, the RIAA says, sales reached $224m, up by 13% year on year. In 2019 as a whole vinyls reach $500m and exceed those of CDs for the first time since 1986". (https://www.economist.com/, Oct, 2019, The strange revival of vinyl records)

"Even so, vinyl still accounts for only 4% of the market for recorded music. Sales of CDs have been declining fast. Revenue from sales of used records is particularly significant in the digital era, now that most of the attention is on streaming, where users can't "resell" music. These days paid-for streaming services, such as Spotify and Apple Music, bring in 62% of the industry's revenue—which is in turn less than half of what it was 20 years ago in inflation-adjusted terms, despite a recent improvement" . (https://www.economist.com/, Oct, 2019, The strange revival of vinyl records)

Regardless of whether it is just a farewell tour or something more reliable, the comeback of vinyls owes something to nostalgia. In 2018 the sales of the the Beatles LP were more than 300,000 vinyl records. David Bowie, Fleetwood Mac, Led Zeppelin, Pink Floyd and Queen all sold more than 100,000. Yet, there might be more to it than that. Its disciples have long asserted that it yields a more quality sound than digital leaders, and it appears that younger fans are learning to appreciate the LP as well. (https://www.economist.com/, Oct, 2019, The strange revival of vinyl records)

"In 2016 about a big amount of f British vinyl-purchasers were 35 or younger, as indicated by ICM, a surveyor; only 18% were between 45 and 54. Doug Putnam, a 30-something Canadian vinyl fan, has purchased HMV, a struggling British high-street music chain. Currently every HMV shop now stocks 3,000 to 7,000 collections, up from an average of 500 in the past few years".
(https://www.economist.com/, Oct, 2019, The strange revival of vinyl records)

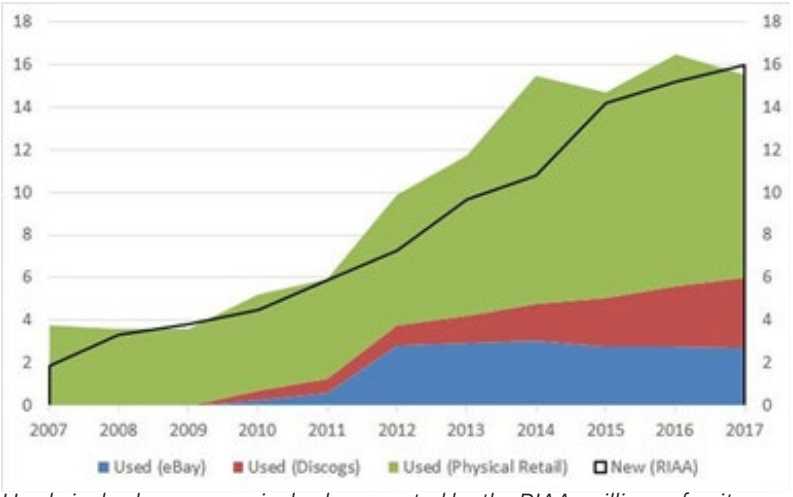


The music industry doesn't try to check the amount of sales because no funds from used sales go to record labels, artists, or songwriters. "Given the size of the overall market, I am always shocked that these num¬bers are ignored when reporting sales," says Ron Rich, SVP of Discogs Marketplace, which is among eBay, one of the two biggest digital marketplaces for used records. (www.forbes.com)

In honor of eBay's first-ever Vinyl Obsession Week, the organization has offered an uncommon look into its vinyl sales information. Discogs provided information for this story as well. Discogs is an online platform of detailed information about physical music products, mostly vinyl. This platform launched in 2000 and started to build in marketplace in 2007. (www.forbes.com)

Both Discogs and eBay have an important amount of catalogs of reused vinyl records available. Discogs lists 5.7 million used vinyls in its marketplace from U.S. On the other hand eBay lists 2.3 mil¬lion used vinyl items from U.S. sellers.
Amazon is likely the third-biggest platform and it lists about 900,000 reused vinyl records on its U.S. site.

If those numbers appear to be small compared to streaming catalogs like those of Spotify and Apple Music remember that Amazon is the biggest online merchant of new vinyls, however lists "only" about 300,000 new LPs. (www.forbes.com)



Used vinyl sales vs. new vinyl sales reported by the RIAA, millions of units. Sources: eBay,... [+]
GIANTSTEPS MEDIA TECHNOLOGY STRATEGIES

Every year million vinyl record are sold via these online marketplaces. As the graphic beside demonstrates , unit sales numbers from eBay and evaluations based on Discogs one year ago data increased to about 6 million. Compare to new vinyl sales, which reached 16 million units and $395 million in revenue last year, according to RIAA figures. (Skep¬tics counter that this is a far cry from vinyl's early 1980s market peak, when vinyl pulled in $2 billion from 300 million units.) The fig¬ure also shows Discogs' sales are increasing at roughly the same rate as new vinyl sales, while eBay's sales have stagnated. (www.forbes.com)

As the time goes by serious record buyers as well as sellers, prefer to use Discogs. This happens because this platform requires that sellers submit highly detailed metadata about music releases, including country of release, pressing and social information, artist credits, and conditions of both discs and sleeves , whereas eBay doesn't do this. It requires more effort to arrange your records on Discogs, but collectors prefer to have all these information listed. (www.forbes.com)

However these figures don't count offline sales, of which there are more than online. Discogs' Rich says that their online sales represent only "a fraction of what is out there in the used market, considering the amounts of used inventory selling through local record stores." (www.forbes.com)

Customers look through racks of records at Rough Trade East in London on Record Store Day 2014. Photograph: Frantzesco Kangaris/The Guardian

1.4 Appreciating vinyl

All started with the first phonograph of Thomas Edison in 1877, which played back sound from wax cylinders coated in tin foil. That led to the vinyl records and the turntables, which eventually became main objects in most households. In the mid-1960s, along came tapes and 8-track tapes, making it easy to listen to favorite tunes.
After that digital recording was came out on the scene, opening the path line to CDs and then to streaming, which is at a high level nowadays.

Vinyl has not only been related to the niche collector's in the market. According to Billboard over 14 million vinyl records were sold in the United States alone in 2017, the highest level since 1991.

Here are some feasible reasons to explain the return of the vinyl:

1. Tangibles and tactiles.

Ownership is something that is missing from subscription streaming services although they provide remarkable access and accessibility. The streamed digital files are not in your possession. On the other hand, you can create a collection with vinyl records, as they are physical tactile items. Someone can hold vinyls in their hands, purchase them and discuss again and again with record store owners or employees and music lovers. Appreciating vinyls also provides other tangibles, such as Lp's artworks

2. The Cool Trend.

Nowadays half of all recent vinyl record buyers are more or less under the age of 25, while every new generation inspire by the past, present and future. It is a trend, to make concepts of the past cool again and there is no doubt of that, while this happens in every category of art. Apparently, repackaging old Lps and announce them retro, makes them more attractive to trend chasers.

3. Vinyl Collectors.

Record collectors are supporting the rebirth of vinyl. It is more than priceless when someone discover a rare album in a dusty shelf in a small record store and add it in their collection. For my experience people who buy vinyl records are more than 30 years old. Collecting records is, by no surprise, a fact that connects people who grew up with vinyl with their youth memories.

4. The Deepest Listening Experience.

As the time goes by, the way people listen to music has extremely changed, due to the increasing of streaming music. Despite that fact, vinyl lovers are still spending most of their time or spend a lot of money on committed Hi-Fi setups in their room. However having a pleasant set up of speaker system along with a good turn¬table and stereo receiver is just a piece of the traditional experience. Moreover it's about sitting down and fully listening to music, listening to an album of your favorite artist, while listening to streamed music is extremely easy.

5. Quality of sound.

A lot of people, experts in old-school audio sounds, believe that the sound provided by vinyls are better than the digital audio, especially from the compressed formats, used by digital streaming. Of course there are better digital formats available in the digital marketplace, such as FLAC (Free Lossless Audio Codec), but it's difficult to find them or possibly pay extra for buying them, whereas vinyl is easily available from both online stores and local record stores.

6. Surface Crackling Noise.

Part of the vinyl ritual is the trill of the needle and the irregular crackling sound. Romantic, sensitive or artistic individuals are keen on this sound detail. It adds color to the total experience.

discogs.com

1.5 The Ritual

Vinyl collectors don't just listen to music, they turn it into an experience. They are keen on touching their music, especially when they take the record out of its case. They appreciate the album and the small printing on the artwork. They place the needle on the record and appreciate the crackling analogue sound. Similar to a concert, the whole procedure consists of an amount of rituals and symbols that provide to listeners, experience music in a unique way.

This clumsy process of putting on a record refers to a ritual, an experience that reflects the love that artists show on creating the work. First someone has to find the specific record, like a long treasure hunt, while this might take some minutes depending on the size and grouping of each collection. When someone finds the appropriate record, they pull it out. They take the album out from its sleeve (the outer and the inner paper). After that, the vinyl lover rotates the inner sleeve in order to avoid the album from accidentally slipping out. Then they place the record carefully on the turntable plateau: the hole so accurately punched that it needs to push the album gently down in order to fit right.

Both the album itself and the turntable needle are items that demand the listener's respect. One important thing is that each record must be clean of dust. A Hi-Technology Record Cleaning Fluid and a brush are required. User should gently sweep the needle with the brush, which produces a satisfying whooshing from the speakers.

Then user should place the brush upon the record, careful to orient the nap in the right direction. Last but not least user have to lick a finger of the other hand, place it in the center of the record, and carefully rotate the platter beneath the brush. The vinyl disk is ready to spin.

Don't underestimate ritual and .tactility

1.6 The disadvantages of vinyl records

Of course there are the cons of the vinyls as well. Below i attach the most important disadvantages.

1. Maintenance and Care

Vinyl is much more difficult to be maintained than CDs, and should be stored in specific temperature or humidity. Moreover mold can affect vinyl and may damage it, as well as its sleeve, or it can spread from record to record. Turntables and cartridges need annual maintenance and adjustment by an expert. Otherwise the user must learn how to adjust a system by hand, which may take too long in order to achieve the perfect tune.

2. Easily Damaged

Vinyl is very sensitive and it is quite easy to be damaged. Any scraping of the surface can affect the sound quality forever. You have to be very careful every time you play a record in order to avoid the risk of permanently damaging the record. Repeated playback with an extremely used or misaligned needle may cause permanent loss of your music.

• Surface Noise
None can avoid the surface noise, while it will always be present and perceptible, even on a brand new album.

• Tracking Errors
The sound quality of a record cannot be determined until you play it, increasing the risk of the purchase. Sometimes even brand new albums can have important pressing and warping issues that may make it useless for listening. Distortion from some parameters of recording procedure, like the vertical tracking angle or the stylus rake angle is generally considered to be audible and almost impossible to correct.

3. Expensive

A high quality vinyl system is much more expensive than a high quality digital audio system. Moreover vinyl equipment and accessories are notoriously expensive and some times extremely difficult to find them. Most of the times vinyl lovers purchase hundreds of dollars worth of equipment that they may not need.
Needles and Cartridges are another important issue, as they need annually replacement. The cost of a high quality cartridge is generally between $60-$6000. Financially, there are plenty of benefits of the cheaper media solutions that they are compared against the cost of the equipment required to play and maintain a vinyl

Chapter II
Design
Part 2 - **DESIGNING A VINYL RECORD CUTTER DEVICE IN A POST MODERN ERA**

2.DESIGNING A VINYL RECORD CUTTER DEVICE IN A POST MODERN ERA

2.1 Thoughts before design

• Designing for several senses can be more dynamic than designing for only one. This is the reason why digital apps, which incorporate sound (button clicks, etc.) and tangible sensors (haptic feedback) in addition to visual cues generate better user satisfaction than those that are totally visualised.

• Designer should always take into consideration user's perspective, as well as every visible feature of their psychology. For example, childhood may affect the perspective of a person as well as the design. There might also be a touch of disobedience in the sake of refusing technology for something simpler and more user friendly.

• Speed and easiness is not always priority. It is quite odd but sometimes people want to take their time, specifically if an experience involves a memory. By making everything so easily accessible, we are leading to reduction of values.

• Some people believe that in order to respect to themselves, they have to offer an embodied ritual on listening to music that removes them from their daily digital life. Time spent can give value and meaning to some procedures.

2.2 How a vinyl is pressed/Pressing machines & cutters

The most interesting thing, for a music format, is the way that records are pressed through this industrial and mechanical procedure. From growing stampers in chemical baths to shrink-wrapping the gatefold sleeves, the pressing of a record is at every stage both an incredibly physical and exact process.

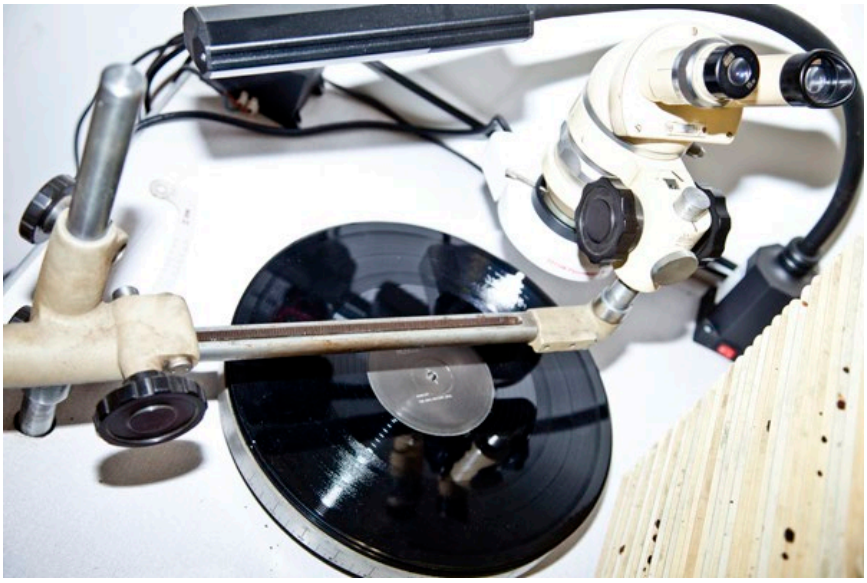
Photos: Marco Walker, Captions: Stephen Galton.

•Metalwork baths. The masters, positives and stampers in these baths, are grown via electro-plating with nickel.
• A piece of metalwork before it's put in the bath.
• A piece of metalwork being placed in the metalwork bath to be electro-plated.
• A 'de-horning machine'. This spins the 'positive' metalwork, whilst a technician polishes the grooves. This removes all the 'spurs' at the top of the groove which would otherwise affect sound quality by introducing clicks if not removed.

•Listening room.

Listening to 'positives' in here to check for aural imperfections before the grown of a stamper.

Photos: Marco Walker, Captions: Stephen Galton.



Photos: Marco Walker, Captions: Stephen Galton.

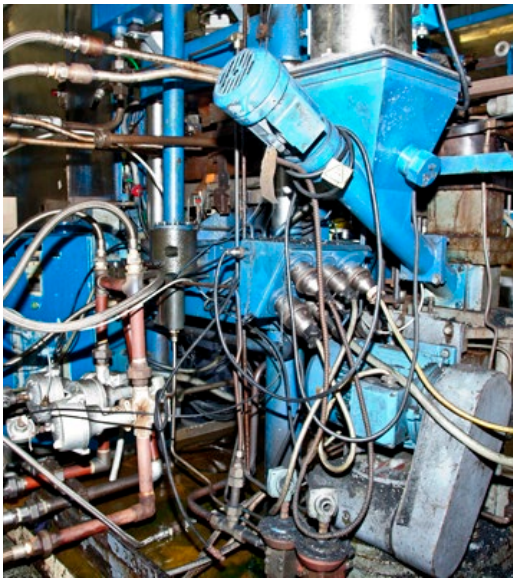
• Miscroscope for checking groove damage.
• A stamper being coated with a protective plastic firm. This is to make sure no impurities get to the grooves before the record is pressed.
• A centre hole being punched into a stamper. A stamper covered with old bits of plastic.

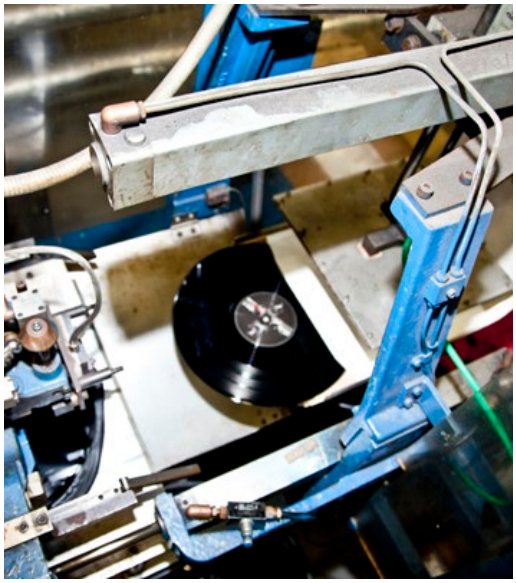
• A forming machine that shapes the stamper to fit the moulds in the pressing machine.
• PVC pellets that are used to make the records – that hose is sucking them up and distributing them to the machines.

Photos: Marco Walker, Captions: Stephen Galton.

PVC pellets

• Pressing machines.





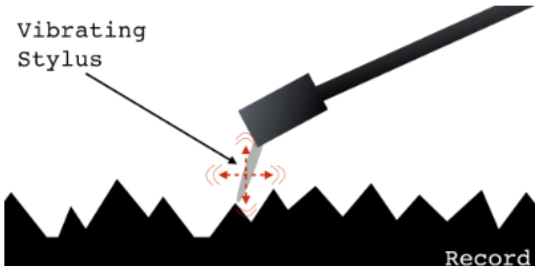
Photos: Marco Walker, Captions: Stephen Galton.

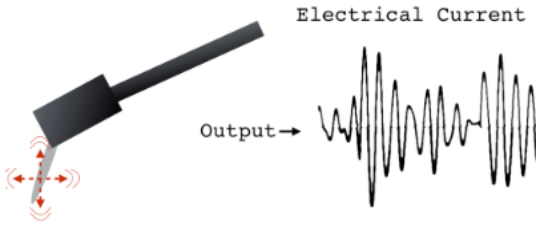
• The part where labels are dropped on to the record in the pressing machine. That long thin shaft in the middle (the 'label pin') is what makes the centre hole in the records.
• The pressing machine, showing the record being auto-packed into an inner sleeve.
• 'Failed' records ready to be recycled.
• Smashing out the centre label from the failed records.
• Failed records that are being crunched up to pellets again and recycled. They only use 1% of recycled material per record at the most.
• Finally the gatefolds are ready to be packed.

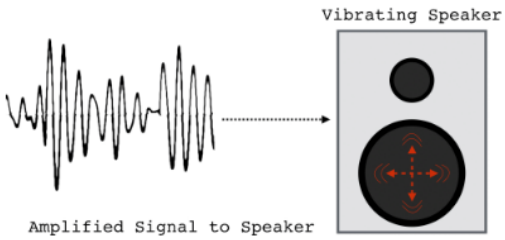
2.3 How a record player works

While the usage of technology in the field of recording devices is steadily improving, record players are still based on the needle in groove concept. One of the breakthroughs of Berlin, is the turntable, that has been improved and automated to spin the record with the help of a belt or a direct drive system. As the record turns, a needle stylus 'reads' the grooves. This needle is supported by an elastic band of metal and is made from a hard material, usually diamond.

"The stylus is set at one end of the tone arm, which is set at the side of the turntable, parallel to the record, and moves across the record while the stylus follows the spiral groove. The stylus picks up vibrations as it moves through the grooves of recorded sound, and those vibrations travel along the metal band at the end of the tone arm, to wires in a cartridge at the end of the arm. A coil in a magnetic field turns the vibrations into electrical signals, which are carried along wires to the amplifier. These boosted signals are finally turned back into sound through the speakers, producing the sounds and music recorded on vinyl records". (https://www.livescience.com/ *Live Science Staff March 26, 2012)*







http://www.soundsetal.com

2.4 How the cutting lathe machine works

"Lathe is a machine that helps in shaping several material pieces in the desired shapes. A lathe is a machine that rotates the piece on the axis in order to perform various operations like cutting, facing, knurling, deformation and more. Generally and simply put, a cutting machine is a record player whose pickup works in reverse. When playing a record, a voltage corresponding to the audio signal is generated in the cartridge. On the cutting lathe, the groove is cut into the lacquer by the cutter head's stylus movements, which corresponds to the audio signal. As with record players, the mechanical stability of the cutting lathe's parts and components is crucial to the sonic result". (http://www.engineering-articles.org/ Manufacturing TechnologyAugust 26, 2015)

2.5 Competitors

Below there are some examples for vinyl presser/ cutters in the market place.

1 The DRC

Machina.Pro is a company based on Australia and has successfully funded a Kickstarter, promising record pressing procedure update and at the same time bring it to the mass marketplace. "*A complete Desktop Record Cutting package capable of cutting vinyl and/or vinyl-like material. The DRC is automated using precision engineered technology for ease of use [for new cutters], whilst allowing custom control, upgrades and modification for the experienced engineer." (www.kickstarter.com ,February 29, 2016)*

2 The PhonoCut

"According to a recent feature from Wired, a group of European designers is readying the world's first consumer-grade lathe-cutting machine market. Promising an "idiot-proof" home vinyl-pressing experience, The PhonoCut allows users to cut any digital audio file on their hard drive to a disc, storing approximately 10-15 minutes of audio on each side". (https://phonocut.com)

3 Vestax VRX-2000

"The VRX-2000 allows users to record vinyl in a small space with minimum additional equipment.

The VRX-2000 has a newly designed stereo cutting head. It does not require a big power amplifier. It operates with a built-in power amplifier. The tracking arm also has a new design".

(https://thevinylfactory.com/, September 7, 2017, Gabriela Helfet)

4 VinylRecorder T560

"Fritz and Ulrich Sourisseau are self-proclaimed vinyl-cutting aficionados, based in southern Germany. Their latest venture is the development of a contraption that fits on to a Technics 1200 or 1210 MkII (as 'industry standard' as things get in DJing circles), and enables the user to cut their own vinyl discs. The VinylRecorder T560, as it's called, looks a little like something from the Frankenstein's drawing board, but is in fact a custom-made, hand-built and incredibly complex device".
(www.soundonsound.com, January,5,2009)

2.6 The goal

Music is so easily accessible these days that we often listen to it in the backround almost every day during our daily tasks. *We don't use to sit down, calm and listen.*

The main goal of this project is to make users appreciate the value of a vinyl record by focusing on the disadvantages of it. All the records you have to unwrap, the smell, the feel of the material. It's a unique experience. Vinyl has an irreplaceable tangible quality in this digital world. Users will listen to their vinyls, while sitting "glued" to their sofa for at least one hour, doing nothing else, simply by focusing on music. This is an extraordinary happiness in this fast-paced world.

The main aspect i want to focus on is that vinyl demands attention. Vinyl's character is stronger than other formats, and this is the reason why it was the most popular format in the past but in recent years as well.

Part of the unique experience of collecting vinyl records are also the spectacular crackling sounds, the warm sound tones, as well as the background noises.

People appreciate records, but they don't know anything about hpw they produced. The goal is to inspire people to think of what they can do with vinyls by raising their awareness about this "phenomenon" called vinyl.

2.7 The idea & the Vision

The basic idea is to design a device that focuses on the value of vinyl and to emphasize to the procedure of listening to music as a "ritual". The aim is to make the disadvantages of vinyl records as the main features of this project.

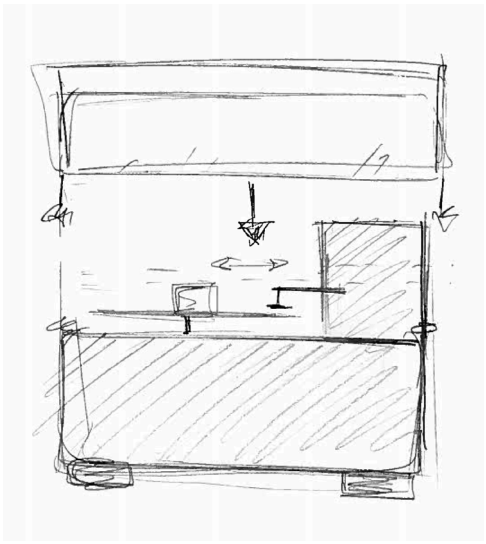
The concept is based on the creation of your own vinyl record, with your own collection of music at home. This project refers to a combination of two home devices, a Vinyl Cutter that enables users to create their own records with the push of one button, and a printer where they can print the appropriate sticker label on each vinyl. These two products emphasize to the tangible procedure of creating music. Moreover the project includes a box-case for putting and storing the ready made vinyls. It is a synthesis of 3 boxes which emphazises to the whole ritual of recording a vinyl.

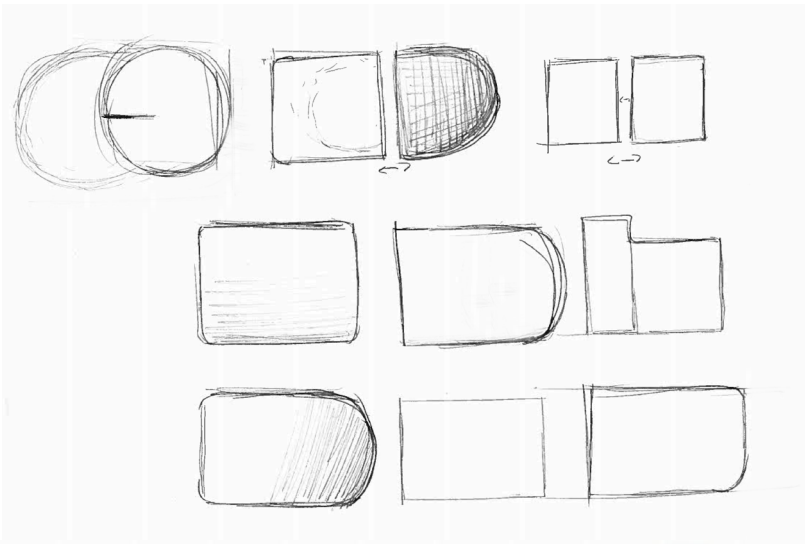
Technology opened up a great opportunity to finally re-think and re-invent record production. This is an introduction of a new chapter of record production with a revolutionary machine that reduces record production to some simple steps.

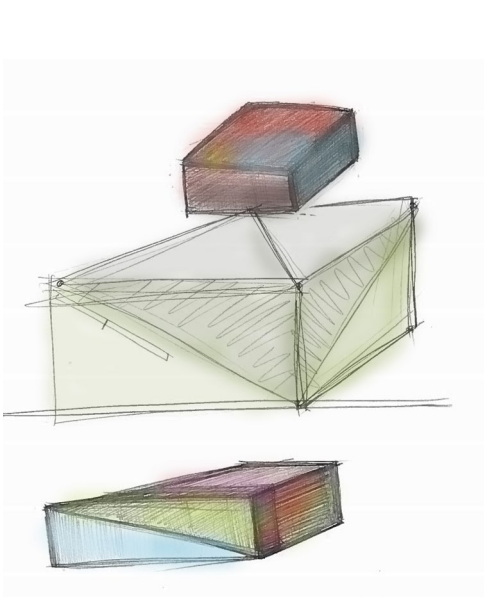
This is an offer of a new possibility. It will never replace streaming or anything, but it will motivate people to create real beautiful, tangible pieces of music on their own.

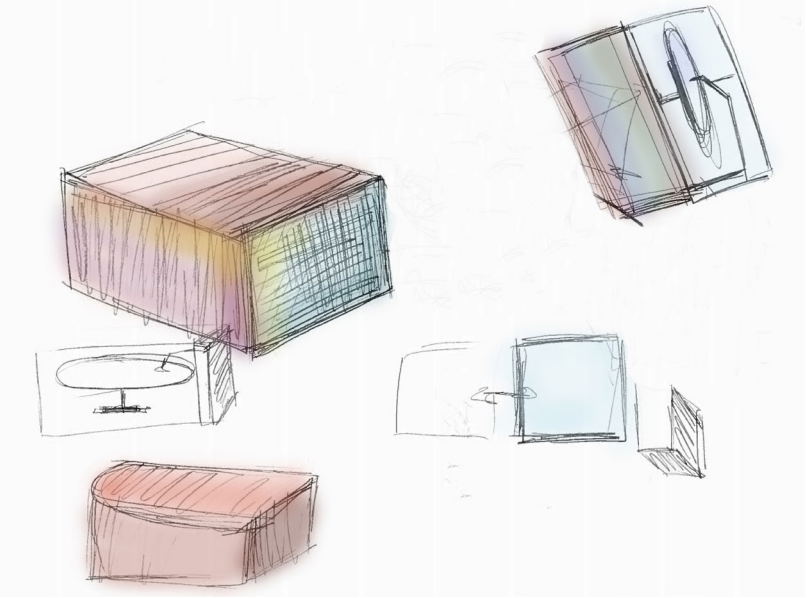
2.8 The first sketches & ideas

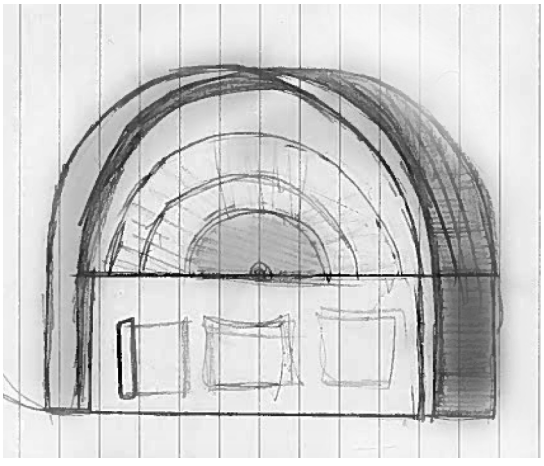
Below there are some first ideas and sketches about how the form and the shape of the product could be.

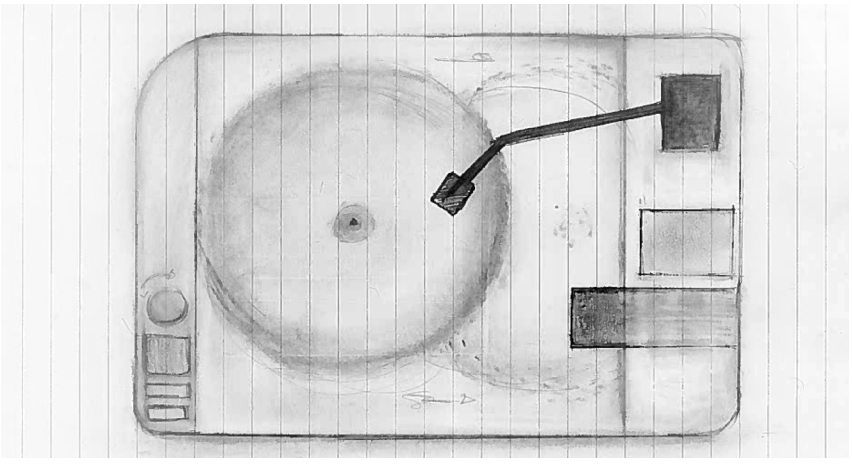


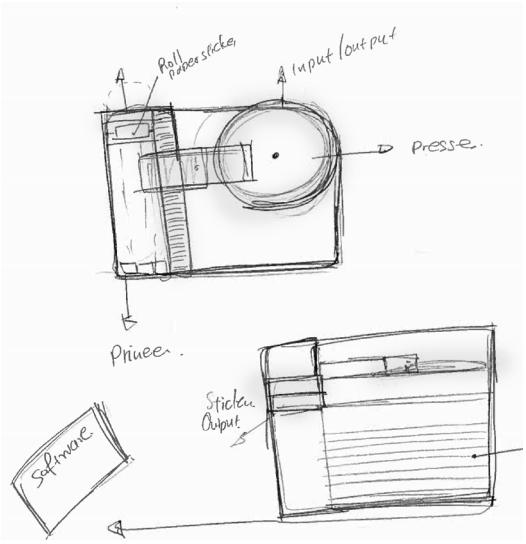


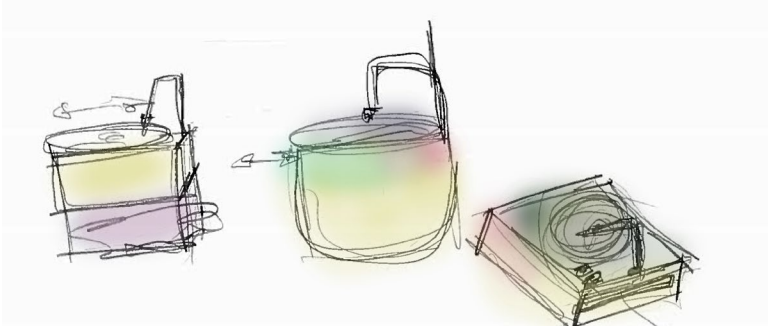


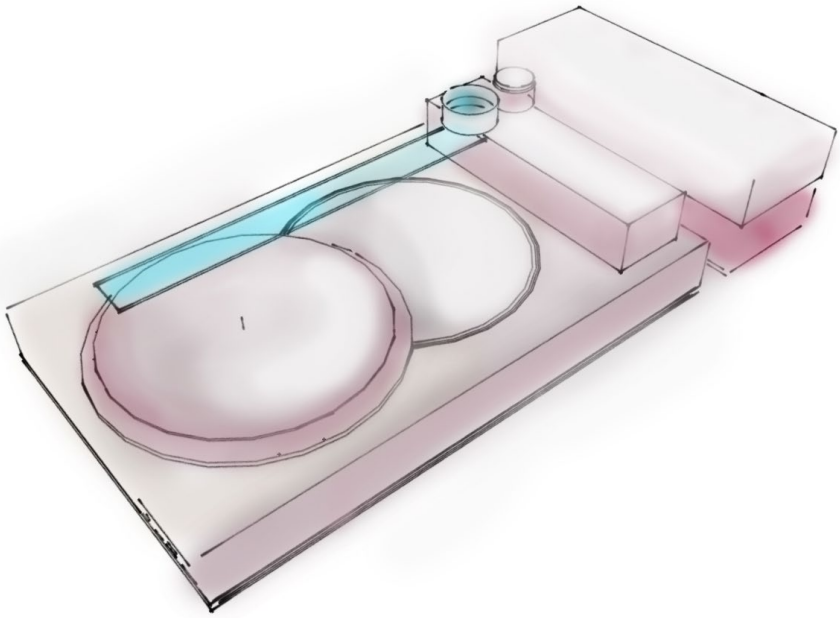


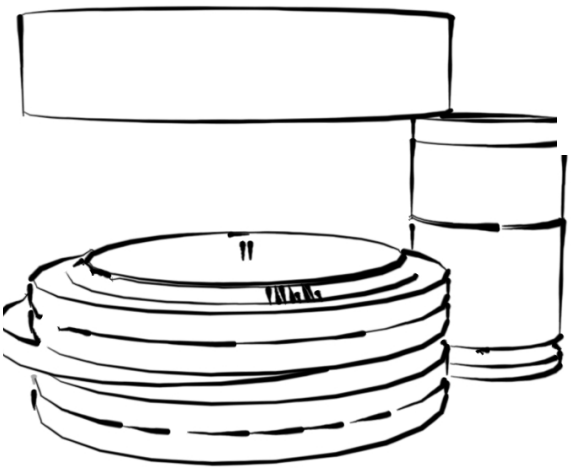


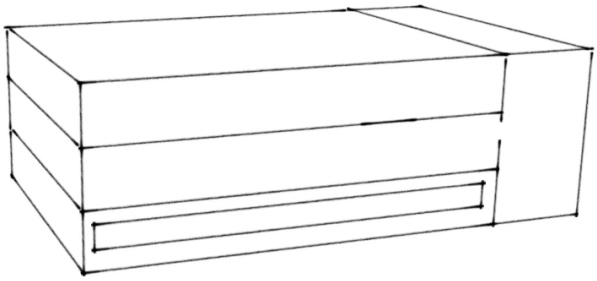


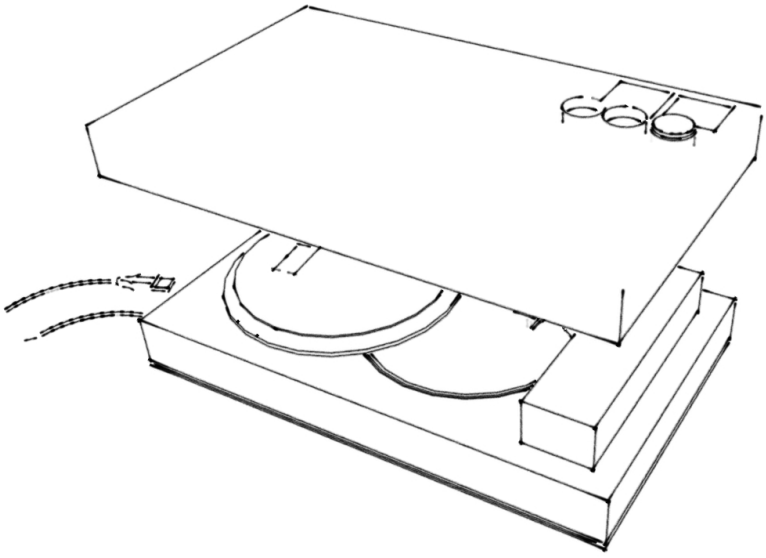

Roll
Input / output
Presse.
Printer.
Sticker
Output
Software

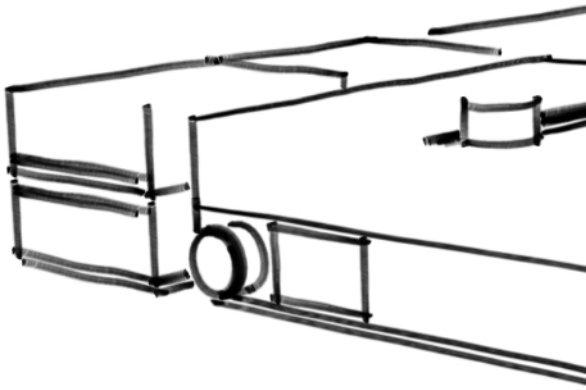


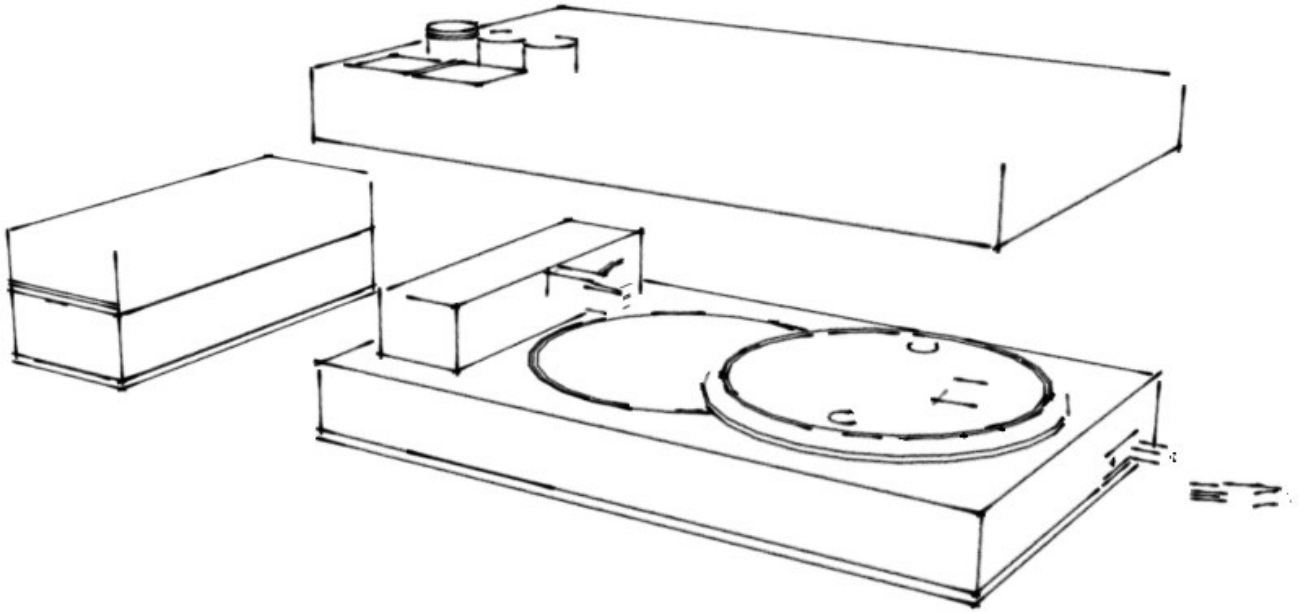


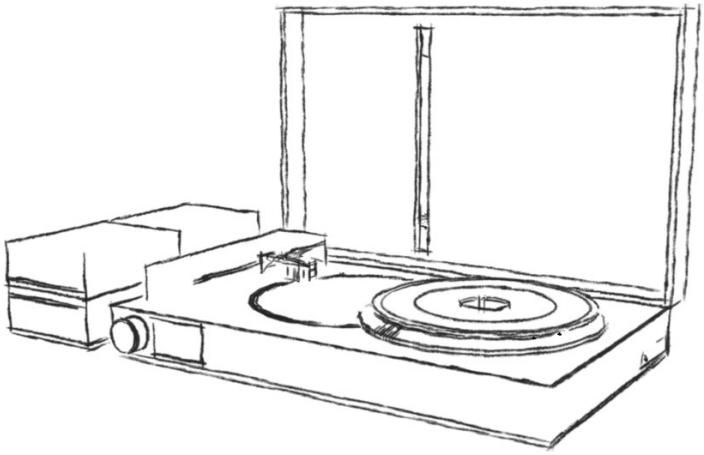


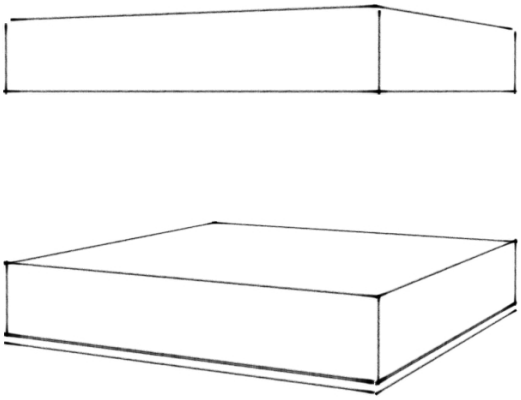


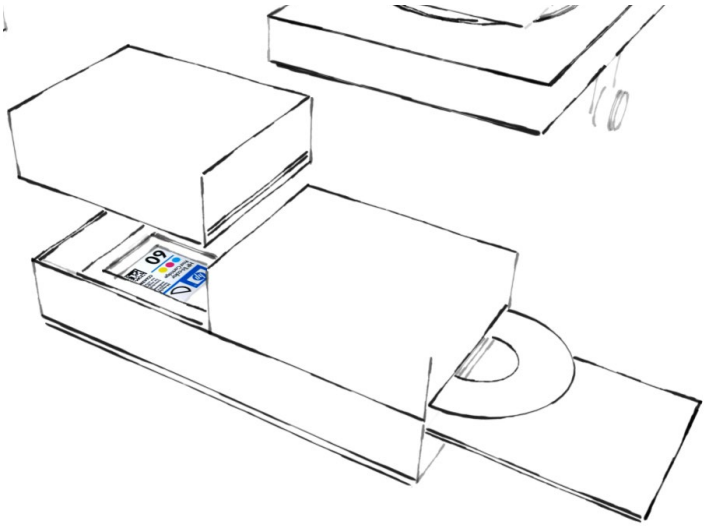


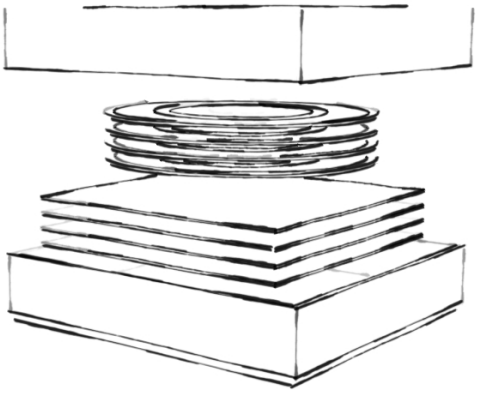












cut module

translate music into lines

2.9 The CUT MODULE

The **CUT MODULE** is a simply revolutionary precision machine that connects to every laptop or pc and can transfer or record music from digital platforms to the analogue vinyl discs. The little printer is a device that can be also
connected to computers and print unique designs on the sticker label for your vinyl.

CUT MODULE is designed only for 45 RPM format vinyl discs. Why?

•*First of all to give value to your choice of music.*

45 RPM record format released around 1950, roughly the same time that 33s were unleashed. Despite using the same microgroove technology, 45s were often called 'singles' because each side normally held just one song. Recording to a 45 RPM format gives you the opportunity to choose only two special songs, one on each side. For instance, if you want to make a "handmade" gift to your beloved ones, you can record two or one special track as a unique gift. This way helps to create valuable memories through music.

•*Secondly, to dicrease the size of the whole device.*

The aim is to create a portable "translator" of digital music to analogue one. This going to be a device for your desktop, or you coffee table and a smaller size helps to achieve that.

How it works?

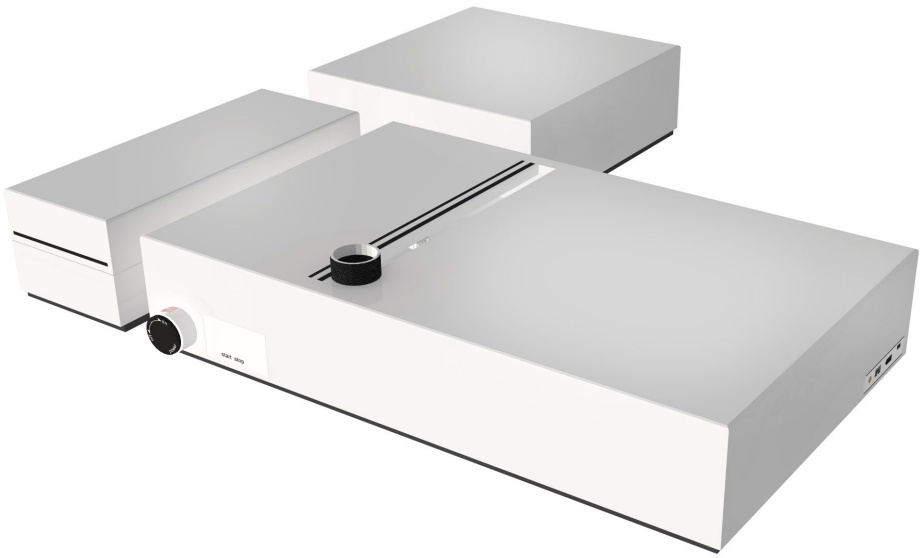
1) Place the Vinyl blank on the platter
2) Connect to the music input of your choice
3) Turn the On/Off button
4) Press the start button

2.10 User Experience

The special thing about this design is that designer focuses on the human senses in order to FEEL the procedure. The user can **touch** the vinyl, you can **smell** it or **lick** it, can **see** the scratching procedure through a moving zoom len on the upper part of the device & can **hear** the scratching sound of creating the vinyl through a slot speaker.

These aspects lead to the ultimate experience.

2.11 Specifications



Good quality of sound

Compact portable design

Waterproof and dustproof

Up to 6 hours of battery life

Spotify Connection Yes

Bluetooth/Cable Connection Yes

Charge via cable Yes

Input & Output Terminals: Stereo Mini Jack (IN)

Magnetic touch

Sliding Zoom len 

Speaker slot

cut module

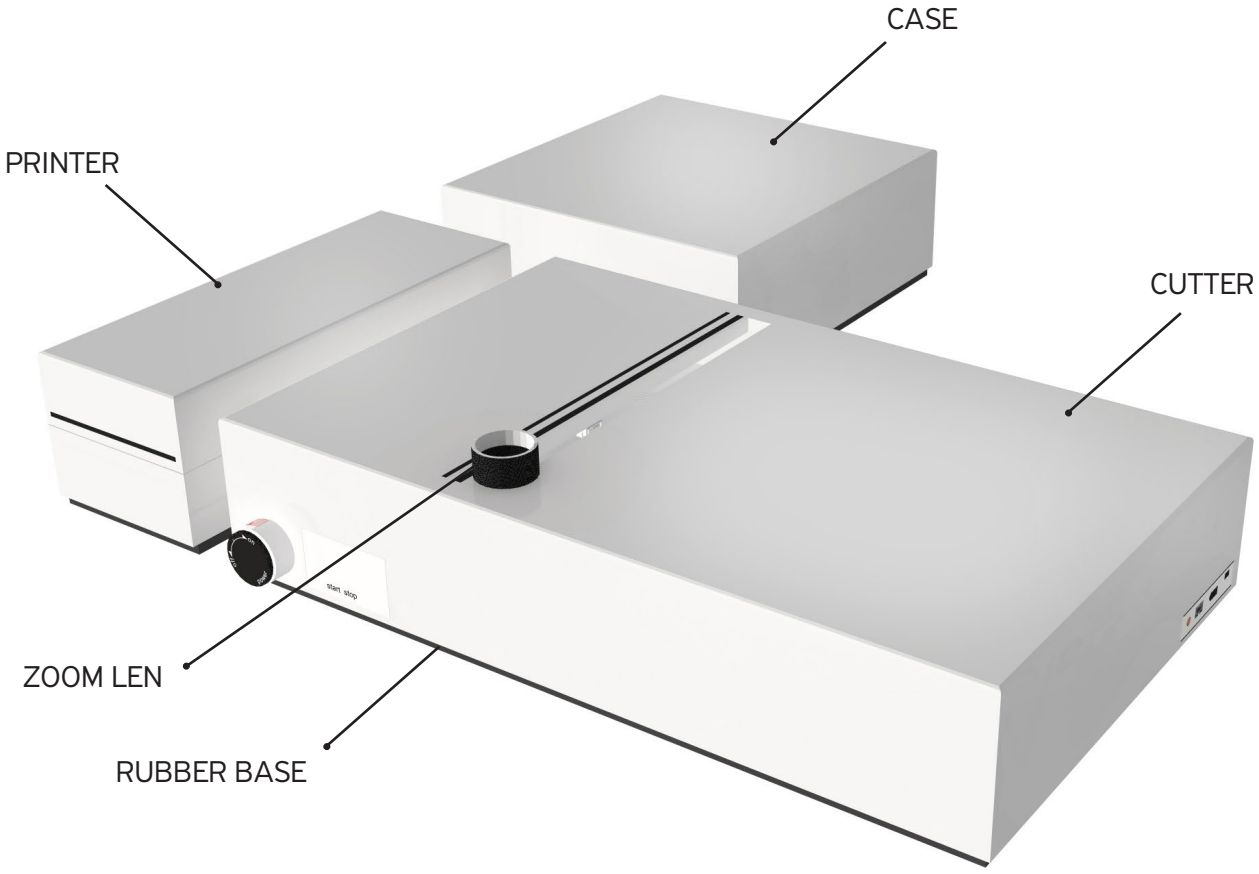
translate music into lines

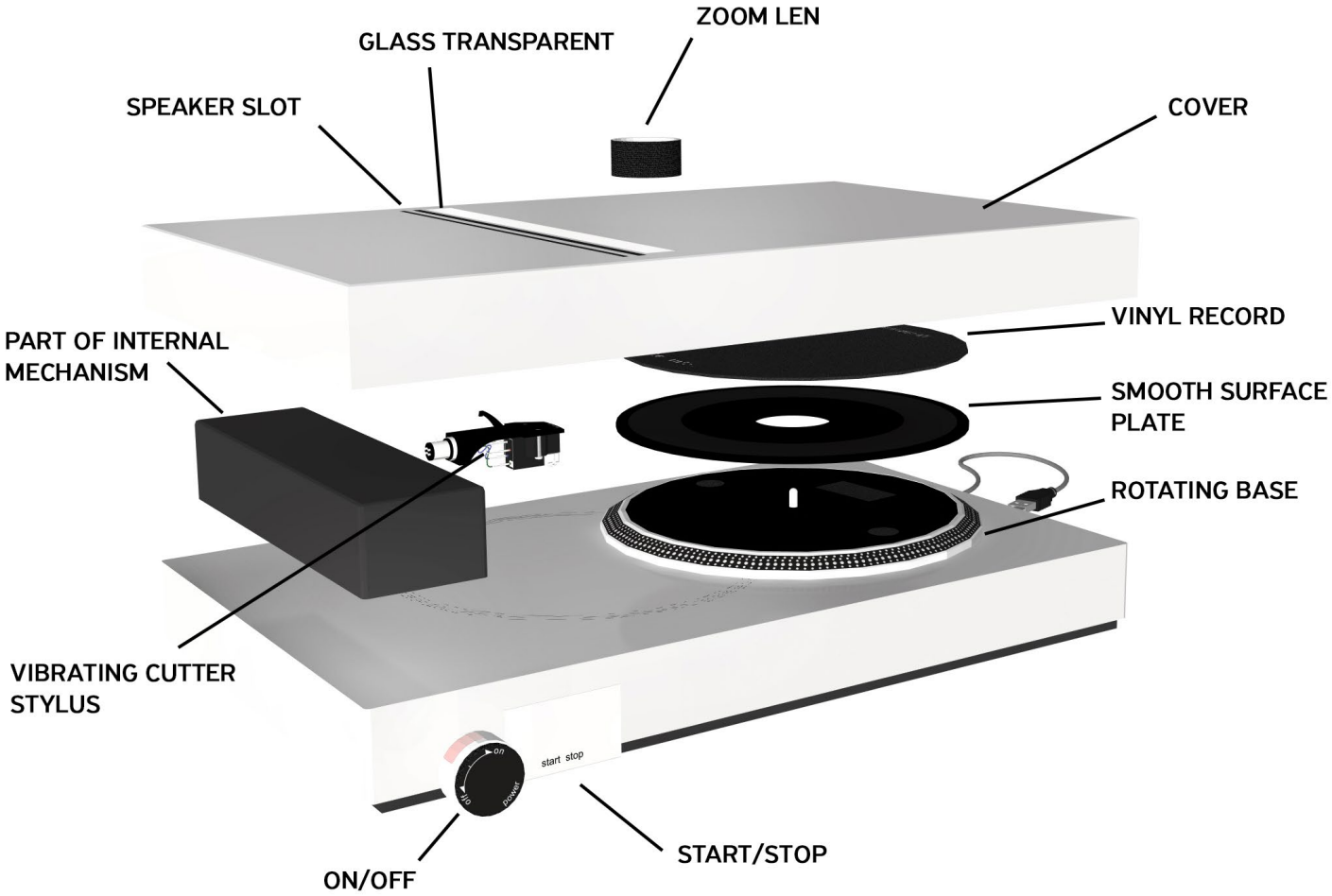
2.12 Aesthetics & Function

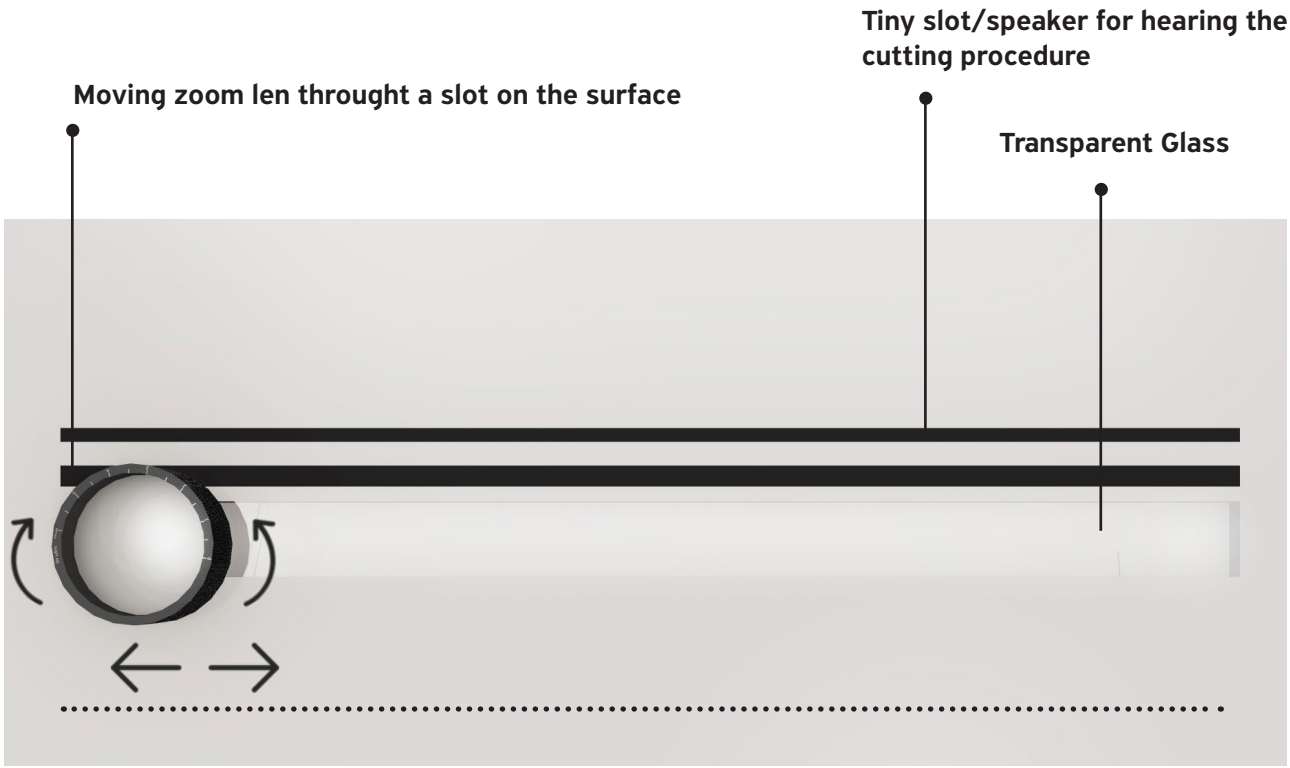
Ispired by one of the most recognized and influential designers of the 20th Century Dieter Rams, **CUT MODULE** keeps a minimal neutral aesthetic with a vision of design that is clearly represented by the phrase "Less, but Better".
White is the main color of the three devices, accompany with some black details. Slim slots and elegant cut lines are some of the basics characteristics.
The design is simple and the function is quite user friendly, as it has only two buttons that someone can use. This is a minimalist and functional approach to design in order to understand the product's purpose.
The project apparts from three white boxes, each one of these hav a different function. The bigger box is the cutter, the side box is a printer and a rectangular box is a case for vinyl cases storage. The material of the boxes is plastic. They are totaly closed in order to keep the cutting and printing procedure hidden. Although a small gap of transparent glass on the upper part of the cutter gives the opportunity to see the cutting procedure through a zoom len.

The concept is based on seeing how music can be translated into materiality. The user can move the zoom len up and down as well as turn the zoom len in and out to observe the cut lines of vibrating cutter stylus on the vinyl material.

The three boxes have a black ***rubber base*** underneath the basic volume, which make them softer, avoiding any unwanted vibration.



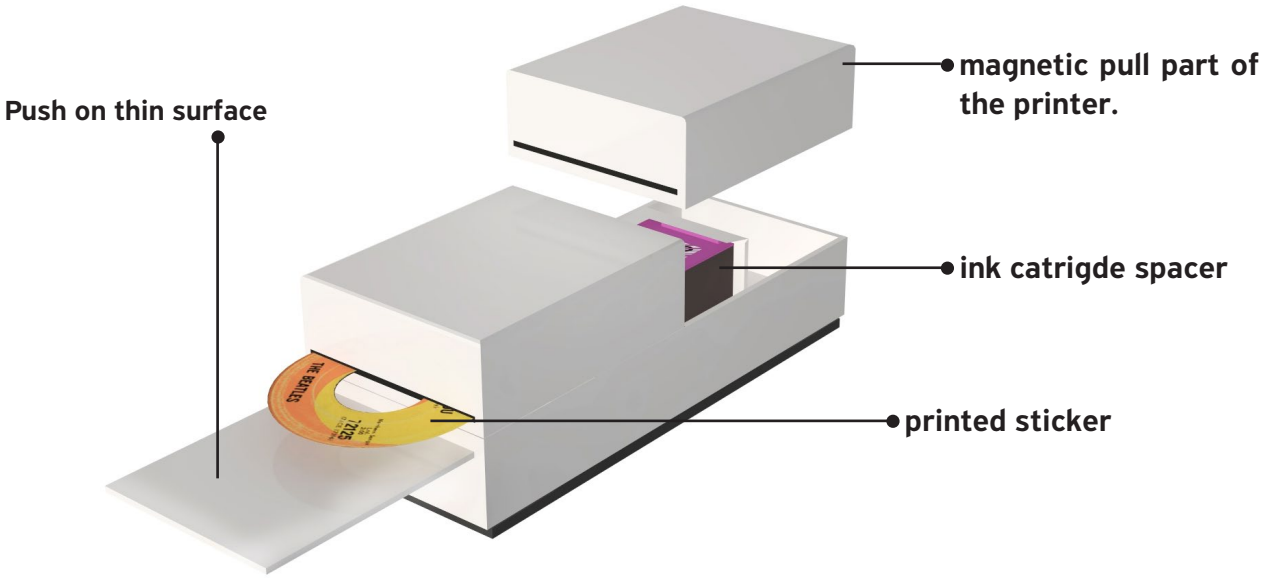


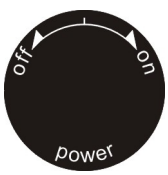


Top View of the upper surface

CUT MODULE is a complex of three rectangular boxes, which create a product synthesis. The use of the product is quite easy , simply by turning on the device and pressing the start button-which automatically switch off when the cutting procedure is done-, but it needs time. It needs time in order to create the music , in order to design the unique sticker and print it. This product reminds us exactly the “ritual” of listening to music on a vinyl turntable as well as mainting the music if you are a vinyl listener.

The **CUT MODULE PRINTER** is connected via bluetooth to any device, like cell phone, laptops, tablets or pcs in order to send the designs for print. It Includes rounded stickers inside and an ink catrigde space. A small thin surface appears by push on mechanism to hold the stickers whine printed.

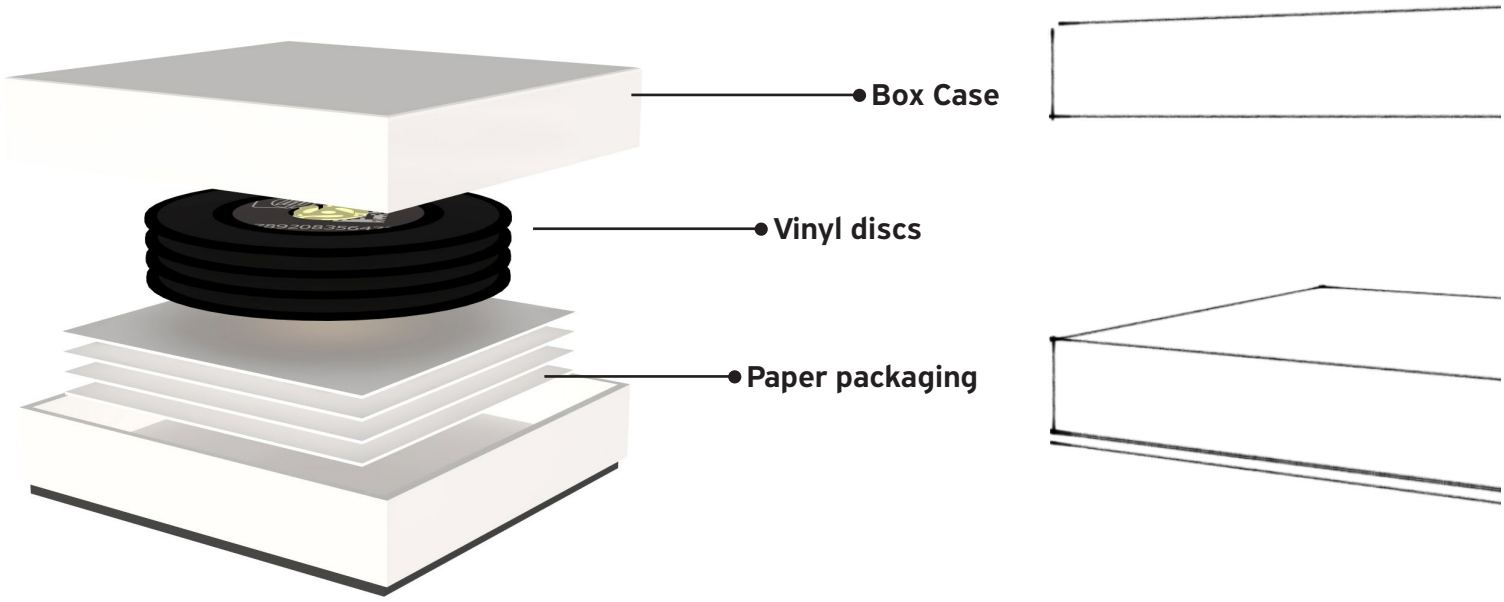




Technics

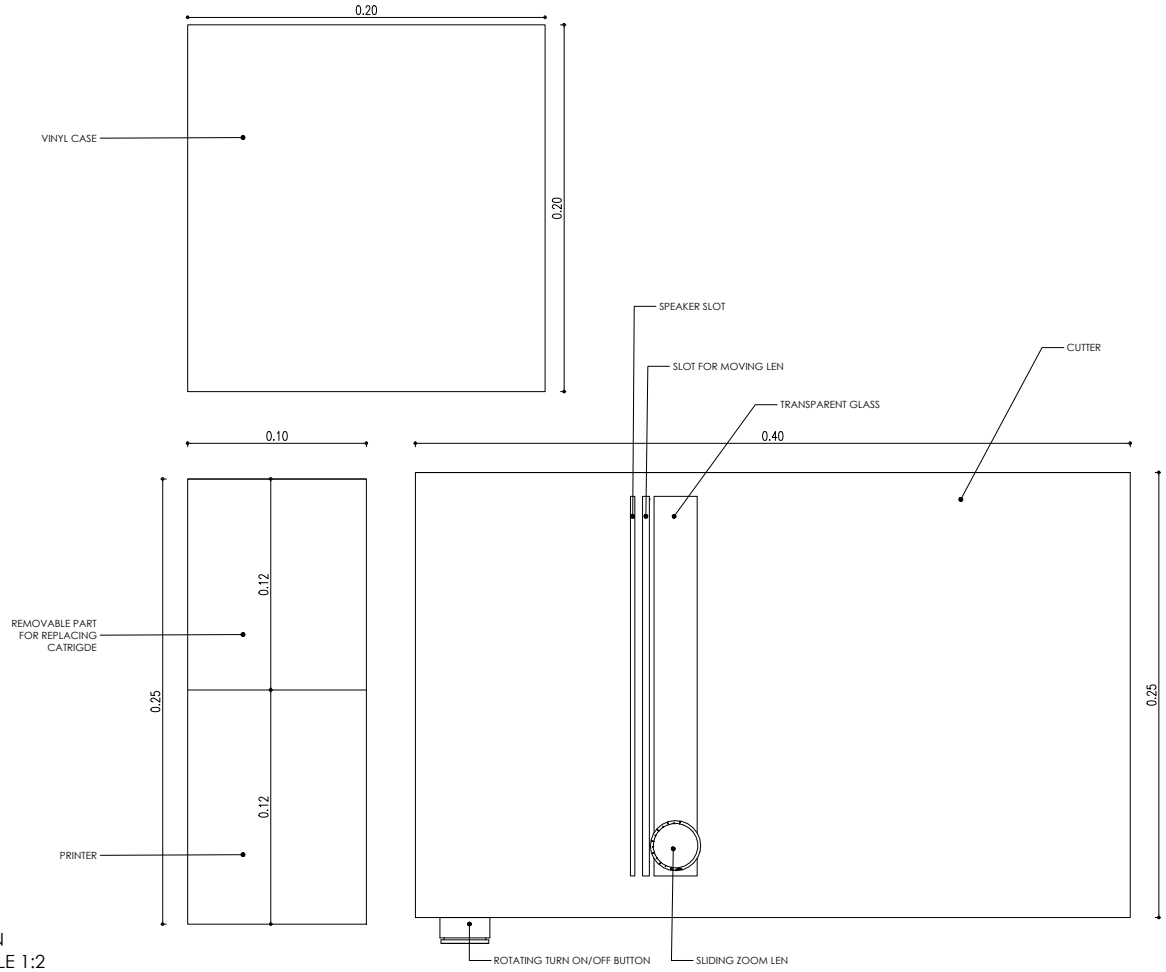
This turn On/Off button looks like exactly the button of the Technics turntables. As well as the start/stop button keeps the similar aesthetics.

The **CUT MODULE CASE** is a box which includes twenty vinyl discs and their paper package.

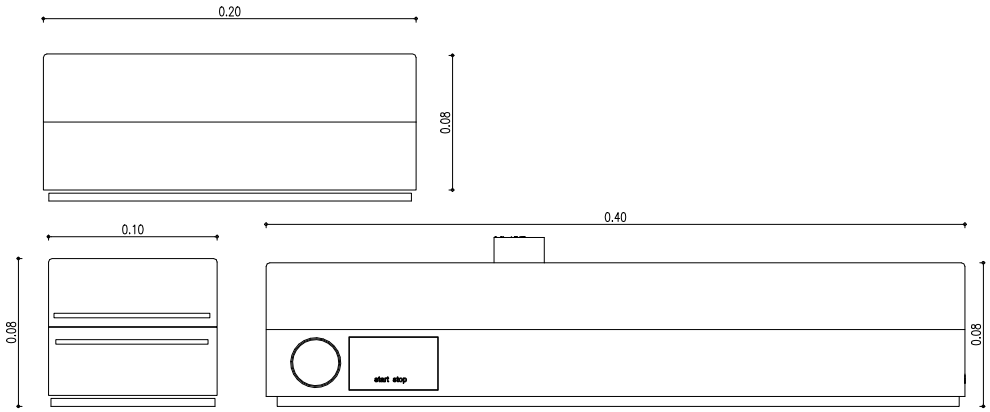


2.13 The drawings & Dimensions

Below there are the drawings of the product.

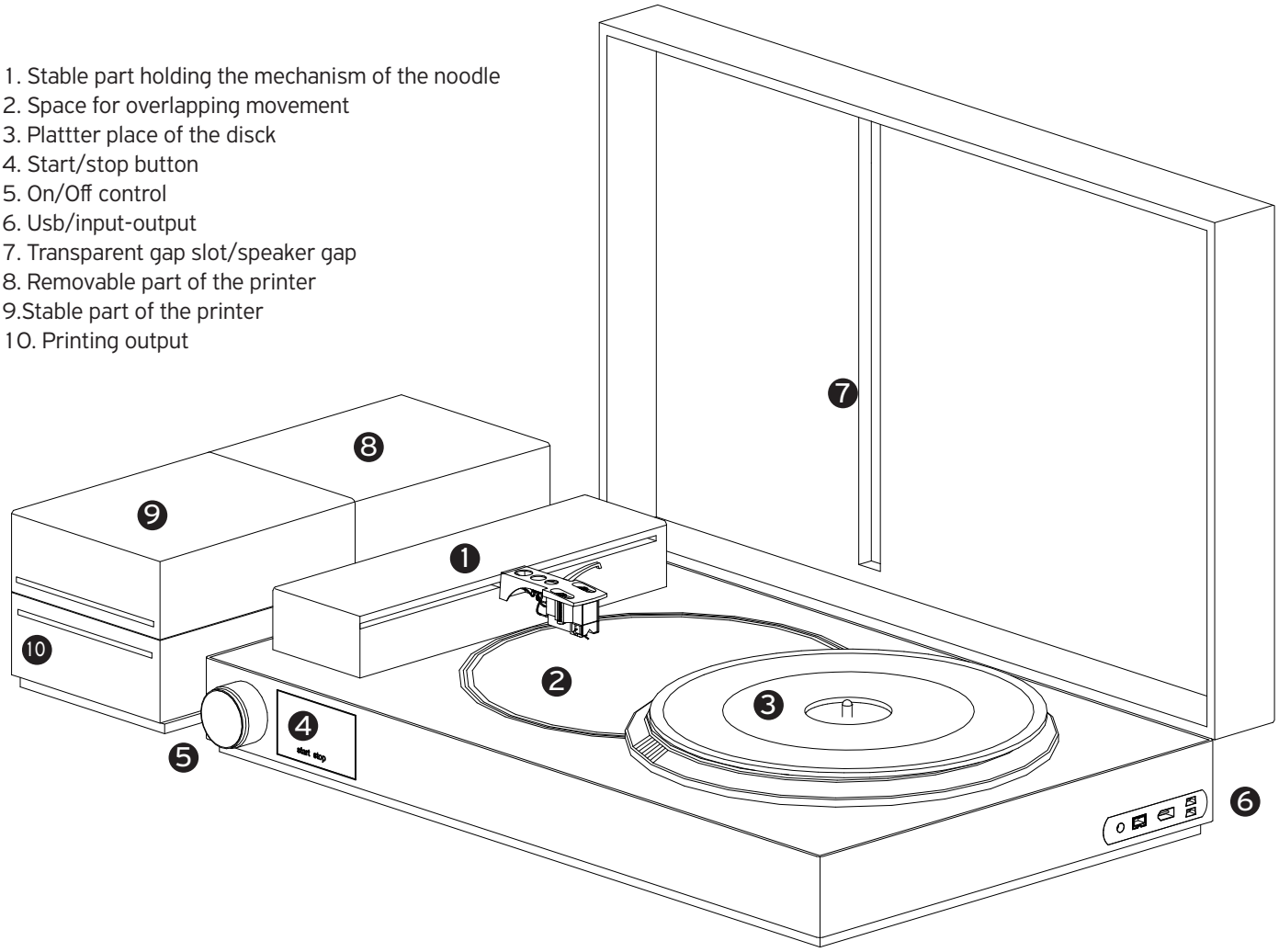


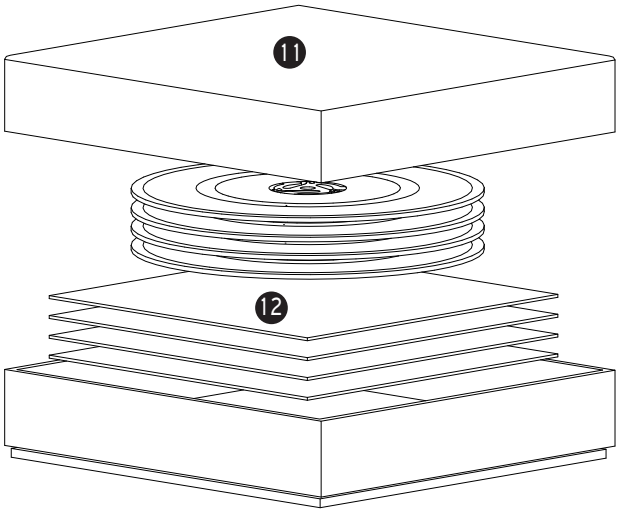
PLAN
SCALE 1:2

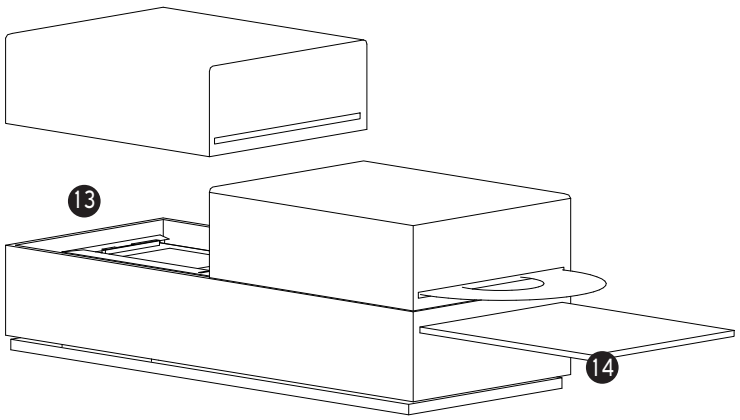


FRONT VIEW
SCALE 1:2

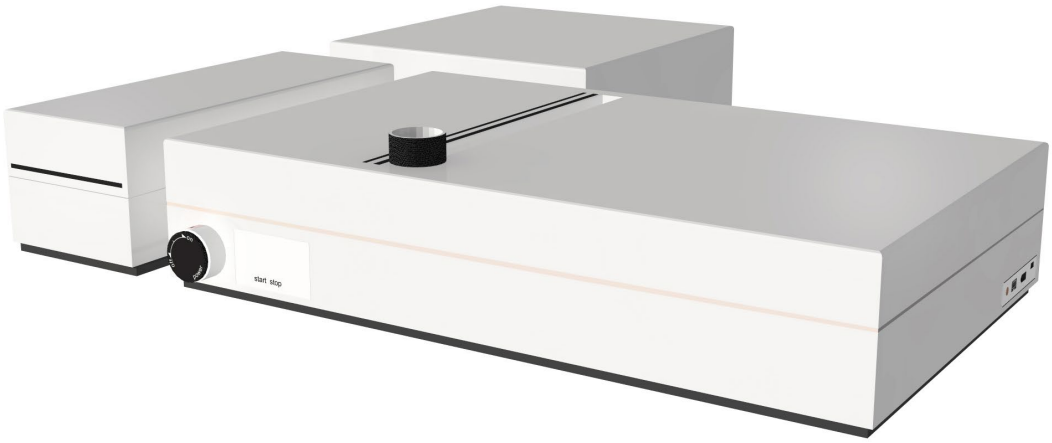
1. Stable part holding the mechanism of the noodle
2. Space for overlapping movement
3. Plattter place of the disck
4. Start/stop button
5. On/Off control
6. Usb/input-output
7. Transparent gap slot/speaker gap
8. Removable part of the printer
9.Stable part of the printer
10. Printing output







11. Lid of the vinyl record case
12. Records
13. Catrigdge
14. Sliding printer holder



cut module

translate music into lines

Conclusions & Recomendations

The general point of the above has been an effort to outline some of the questions on how the process of innovation, gives the opportunity for an older product or technology to become significant again. Of course a product's rebirth isn't always possible. Plenty of products and a huge variety of technologies disap¬pear due to their un-usefulness over time.

The rebirth of vinyl records in an age of digital files and streaming is an example of how innovative design can achieve technological recoveries possible. In the summer of 2019, the physical sales of vinyl albums in the music industry are extremely increased. This follows many years of upward trend these days, while remaining as a niche product, the vinyl may finally survive, being the only analogue means of music, as the sales of CDs are decreasing dramatically.

This is not happening only due to nostalgia issues. This trend stands because vinyl have status as an object, something that attracts buyers to appreciate the physical presence of a product. Nowadays this attraction seems to be very important, while most of the time listening to music does not involve purchasing a physical support.

What has figured out of this dissertation should be thought of as an introductory, but hopefully signifying frame for further research on the analogue rebirth, while this paper is a small step to that direction.

When I am speaking about analogue, I am referring to procedures and products, the two different "phenom-ena" of the design world, which are not associated with digital technology in order to be used. It can be as simple as a paper and a pen, a paint or a modeling clay to communicate an idea.

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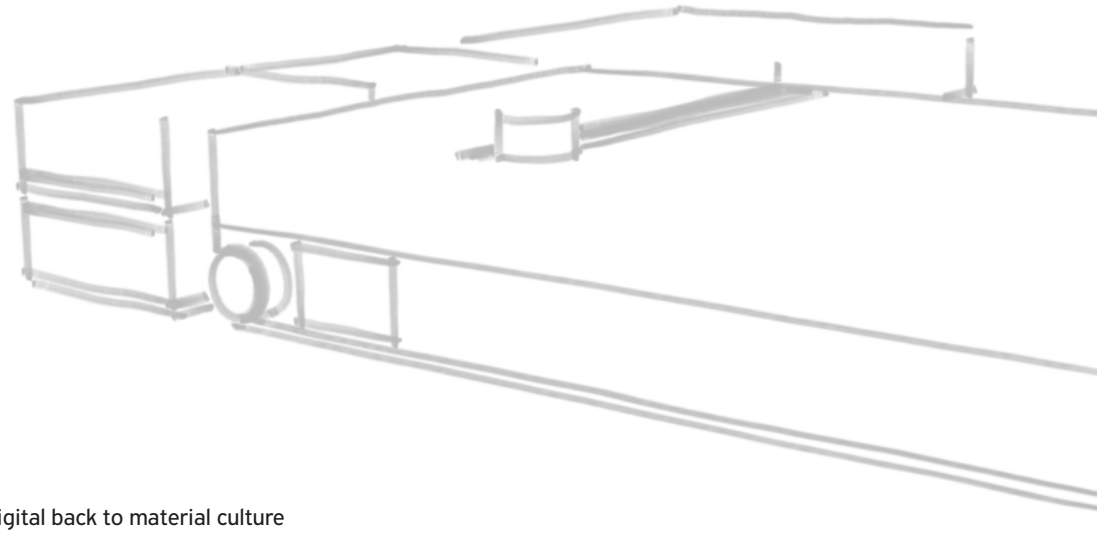

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